ROTARY DRILLING WELL CONTROL
Foreword

Norwegian Petroleum Technology Centre AS (NPS) is a part of the OilComp group. In 2012 the OilComp group was certified to ISO 9001:2008 by Bureau Veritas to ensure that the customer receives predictable training at high quality. NPS was pre accredited as an approved IWCF center in September 2011, with a formal IWCF certification autumn 2012. Certification is valid for 5 years before renewal takes place.

This workbook, which also has been submitted to you as an e-book, will help you prepare for the exercises covered in the IWCF course, which you also will be examined against. The workbook exercises emphasize the different topics from the textbook. The theory and the exercises will be presented during the course. You will also be given the opportunity to ask questions related to the various topics.

Both the textbook and workbook are based on the IWCF certification requirements for either floating drilling operations (Subsea BOP) or operation at fixed installations (Surface). Surface candidates will find some topics in the work book that are not relevant to the IWCF exams.

The exercises in this book are separated in two main sections:

PRINCIPLES & PROCEDURES EXERCISES
The first section consists of exercises related to topics from “Chapter 2 - Theory and Procedures” and “Chapter 3 - Practical Well Control Operations” in the textbook.

WELL CONTROL EQUIPMENT EXERCISES
The second section is related to Chapter 4 - "Well Control Equipment" in the textbook. All exercises are related to each of the 13 topics covered in the textbook.

We hope the text- and workbook will be of use before, during and after the course. We realize that it will always be necessary to improve our material, and would welcome your suggestions for improvements, and look forward to your participation in the course.

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01. Principles and procedures – various exercises

1. While killing a well, you notice that you are gradually losing pump pressure in spite of increasing the pump speed. You see no change in the choke pressure. What is likely to be wrong? (Select 2 answers)
   a. A washout in the drill string.
   b. A washout in a pressure valve (float) in the drill string.
   c. The choke is washing out.
   d. The choke is plugging up.

2. Normal formation pressure gradient is based on a fluid weight of:
   a. 0,83 sg.
   b. 0,86 sg.
   c. 1,00 sg.
   d. 1,03 sg.
   e. 1,07 sg.

3. Which of the following well killing procedures will give the lowest choke and possibly the lowest casing shoe pressures?
   a. Wait and Weight method.
   b. Drillers method.

4. During a trip, mud begins to flow from the drill pipe. What is the first thing you should do?
   a. Close pipe ram in the BOP.
   b. Close the annular.
   c. Install an inside BOP.
   d. Pick up and stab the Kelly.

5. Which of the following situations is likely to induce the greatest swabbing effect during tripping?
   a. When pulling first few stands off bottom.
   b. When drill collars are passing into casing.
   c. When drill collars are lifted out of hole.
6. Which of the following situations will probably result in swabbing? (Select 3 answers)
   a. The mud pump is running while pulling out of the hole with the drill string.
   b. The mud viscosity is high.
   c. Pulling the drill string through tight spots without pumping.
   d. Pulling on the drill string fast.
   e. Pulling the drill string through tight spots while pumping.
   f. Pulling on the drill string slowly.

7. Fractional increase in mud weight for a 3725 m TVD deep well to balance formation pressure is 0.11 sg. What is the shut in drill pipe pressure (SIDPP)?
   a. 41 bar
   b. 40 bar
   c. 43 bar
   d. 38 bar

8. Driller’s method of circulating out a kick can be performed without any calculations.
   a. True
   b. False

9. A gas kick is being circulated out of a well using the Wait and Weight method. At what time does the maximum choke pressure occur?
   a. When the top of the influx reaches the casing shoe.
   b. When the top of the influx reaches the choke.
   c. When the bottom of the influx passes from the drill collars annulus into the drill pipe annulus.
   d. When the influx is in the largest washout section of the open hole.
   e. At initial shut in.

10. What is the effect of ignoring a significant surface line capacity when preparing a kill sheet for a Wait and Weight kill method?
    a. It may result in the well, being over pressured.
    b. It may result in a further influx occurring.
    c. No effect.
    d. The effect will vary during the kill operation.
11. You are killing a well using the Wait and Weight method. The kill pump was brought up to speed holding the casing pressure constant. The drill pipe pressure is 10 bars less than you had calculated. You close the choke and bring the drill pipe pressure up to the calculated initial circulating pressure.

What is the effect on the casing shoe pressure?

a. There is no effect on the casing.
b. The casing shoe will be subjected to an unnecessary additional 10 bar for the duration of the kill operation.
c. The casing shoe will be subjected to an unnecessary additional 10 bar until the influx is inside the casing.
d. The casing shoe will be subjected to 10 bar less than necessary until a further influx has occurred.

12. A kick is being circulated out of a well using the Wait and Weight method. A nozzle washout goes undetected, and the choke operator continues to adjust the choke to maintain the calculated circulating pressure. What is the effect on the bottomhole pressure?

a. It decreases.
b. It increases.
c. It remains constant.
d. It depends on the location of the influx.

13. A kick is being circulated out and the pump fails. The well is closed in and the second pump is brought up to kill speed after lines are displaced to kill mud. Which one of the following procedures would you use to ensure good operational practice?

a. Pump operator brings pumps to kill speed. Choke operator then opens the well to obtain desired pump pressure.
b. Choke operator opens well and pump operator then brings pump up to kill speed whilst ensuring final circulating pressure from previous kick sheet.
c. Pump operator brings pump up slowly whilst informing the choke operator at regular intervals about the increase in pump rate - choke operator maintains last observed reading on the casing pressure gauge.
d. Choke operator turns on pump to kill speed, then traverses the rig floor to operate choke to last observed choke/casing pressure before start of kill.

14. Whilst running in the well, it was calculated that the displaced volume of mud on the trip is less than expected. Which one of the following reasons would explain the observation?

a. A kick / influx have occurred.
b. The well has been swabbed.
c. Some mud is lost to the formation.
d. The mud is out of balance.
15. For which shut in procedure would you line up the choke manifold as follows? Choke line valve closed, Choke manifold through to poor boy open, Choke open.

a. Shut in for the volumetric method  
b. Soft shut in procedure.  
c. Hard shut in procedure.  
d. Both soft and hard shut in procedure.

16. A kick has occurred and all the kick fluid is in the annulus. Which of the following aspects will contribute to the magnitude of the shut in casing pressure (SICP)?

a. High formation pressure.  
b. Volume of kick fluid.  
c. High formation permeability.  
d. Slim annulus.

17. Observing the time it takes for the build-up of shut in casing pressure (SICP) and shut in drill pipe pressure (SIDPP) after a kick is shut in is important because:

a. It gives an indication of high pressures.  
b. It allows time to plan manpower allocation.  
c. It gives an indication of formation porosity.  
d. It gives an indication of formation integrity.  
e. It gives an indication of formation permeability.

18. You have been drilling ahead at 2 m/h for several hours. The well kicked while you were making a connection. After shutting in the pressures are: SIDPP = 16 bar. SICP = 4 bar. The well is flowing up the drill pipe when you are making up the top drive. Which of the following is a possible cause of the high SIDPP?

a. The annulus is loaded with cuttings.  
b. The influx is migrating.  
c. The influx has entered into the drill string.  
d. There is a light slug in the annulus.

19. Why is it usual to kill a well using a slow circulating rate? (Select 2 answers)

a. To reduce the expansion of the influx and thereby reduce the pressure on the casing shoe.  
b. To avoid to exceed the operational limitation of the well control systems.  
c. To create sufficient pressure loss in the circulating system and obtain sufficient overbalance.  
d. To minimize the pressure on the well bore.
20. Does exceptionally high casing pressure towards the end of a gas kick necessarily mean high pressure at the shoe?
   a. No.
   b. Yes.
   c. It depends on the skill of the pump operator.
   d. It depends on kill mud weight.

21. What will happen to the bottomhole pressure during the second circulation of the driller’s method if casing pressure is held constant as the kill mud enters the annulus?
   a. Stay the same.
   b. Decrease.
   c. Increase.
   d. Not enough information.

22. In the oil field the hydrostatic pressure is a function of:
   a. Drill string length.
   b. Pump output per minute.
   c. The vertical depth.
   d. Formation porosity.

23. Kicks will commonly occur if:
   a. Formation pressure is less than mud hydrostatic pressure.
   b. When drilling mud has low viscosity.
   c. When formation pressure is greater than mud hydrostatic pressure.
   d. The hole is kept full during trips.

24. The best indicators of a kick taking place are (3 answers):
   a. Increasing flow rate.
   b. Increasing drilling break.
   c. Increase in the mud pits
   d. A positive flow check.

25. You are drilling ahead at 3765 m. TVD. In the last hour drill rate has gradually increased from 3 m/h to 8 m/hr. You notice slight increase in drag and rotary torque and the gas level in the mud have increased but not enough to cut the mud weight. Pit levels and flow rate have been steady.
   Has a kick occurred? Yes / No
   How many warning signs are noted? 1, 2, 3, 4, 5
   Would you notify toolpusher? Yes / No
26. While tripping out of the hole the well takes only half of the expected volume to fill the hole while tripping. What would you do?

   a. Carry on pulling, everything is ok.
   b. Pull slowly another 20 stands watching fill up
   c. Run back to bottom, circulate and condition mud
   d. Pump high viscosity slug to the bit
   e. Shut the well in and check for flow

27. If swabbing has been recognized, which of the following actions should be taken?

   a. Function test BOP.
   b. Restore safe primary control. Run back to bottom and circulate bottom’s up
   c. Reverse, circulate out a possible influx.
   d. Check for flow, if none, continue out of the hole
   e. Increase mud weight from 1.44 sg to 2.12 sg.

28. In each of the following 4 questions, which drilling parameter is an indicator of abnormal pressure?

   1. a. Increasing mud temperature.
      b. Reduction in drill rate.
   2. a. Increasing mud conductivity.
      b. Increasing shale density.
      c. Decreasing mud temperature.
   3. a. Increasing drill rate.
      b. Reduction in torque.
   4. a. Increase in connection gas.
      b. Decreasing cutting size.

29. When does excessive surging occur? (Select 2 answers)

   a. Pulling the pipe too fast.
   b. Improper mud density.
   c. Improper circulating density.
   d. Running in too fast.
   e. Low mud viscosity.
   f. Tight hole.
30. In which of the following cases would you be most likely swab in a kick?
   a. When the bit is pulled up into the casing.
   b. When the first few stands are pulled off bottom.
   c. About halfway up the hole.
   d. When bottomhole assembly is pulled out of the hole.

31. Diverter vent lines should have small internal diameters to create back pressure necessary for well control.
   a. True
   b. False

32. The Wait and Weight and Drillers methods are based on:
   a. Circulating out a kick with constant drill pipe pressure.
   b. Circulating out a kick with constant bottomhole pressure.
   c. Circulating out a kick with constant casing pressure.
   d. Circulating out a kick with constant pump rate.

33. Normal formation pressure gradient is:
   a. 0.1001 bar/m
   b. 0.1004 bar/m
   c. 0.101 bar/m
   d. 0.1052 bar/m

34. The equivalent circulating density (ECD) is considered the effective mud weight while circulating. Which pressure loss in the circulating system is added to static mud weight to find it?
   a. Surface pressure losses.
   b. Drill pipe pressure losses.
   c. Drill collar pressure losses.
   d. Bit nozzle pressure losses.
   e. Annulus pressure losses.

35. How should the final circulating pressure (FCP) be calculated?
   a. Add shut in casing pressure (SICP) and shut in drill pipe pressure (SIDDP).
   b. Subtract shut in casing pressure (SICP) from shut in drill pipe pressure (SIDDP).
   c. Adding shut in drill pipe pressure (SIDDP) to slow circulation rate pressure (SCRp).
   d. Using the pump pressure/mud weight relationship to the slow circulation rate pressure (SCRp).
36. You notice that you are losing mud at a rate of 2700 l/h while drilling. What should you do?
   a. Increase pump rate.
   b. Shut in the well.
   c. Reduce pump rate and add lost circulation materials.
   d. Adjust mud properties.
   e. Stop circulation and check for flow.

37. What fractional increase in mud weight is needed to balance the formation pressure with a SIDPP of 29 bar and TVD of 4248 m?
   a. 0,05 sg.
   b. 0,06 sg.
   c. 0,07 sg.
   d. 0,08 sg

38. A gas kick has being circulated out of a well using the Wait and Weight method. At what time was the casing shoe subjected to the highest pressure?
   a. When the top of the influx reached the choke.
   b. When the top of the influx reached the casing shoe.
   c. When the bottom of the influx passes from the drill collar annulus in the drill pipe annulus
   d. When the influx is in the largest washout in the open hole
   e. It depends on the holes geometry

39. Which one of the following statements regarding the comparison of well killing methods is true?
   a. The Wait and Weight method always results in a casing shoe pressure which is less than the driller’s method
   b. The volumetric method gives the same annulus pressure as the Wait and Weight method
   c. The Drillers method always results in a higher casing shoe pressure than the Wait and Weight method
   d. The Wait and Weight method will give a lower casing shoe pressure than the Drillers method if the drill pipe volume is less than the casing annulus volume
   e. The Wait and Weight method will give a lower casing shoe pressure than the Drillers method if the open hole annulus volume is greater than the drill pipe volume.
40. A gas kick is being circulated out and rig power is lost. No other pump power is available. Which of the following options would you choose?

a. Close in well and suspend operations. Do not continue until rig power is available.
b. Close in well, close all BOP choke and kill line valves. Keep casing/choke and bottomhole pressure constant using manual choke and observing the SIDPP.
c. Close in well and establish SIDPP and SICP. Allow SIDPP to increase 3 to 7 bar. Bleed off through choke to maintaining the SIDPP until first gas gets to surface or rig power is available.
d. Close in well, establish SIDPP and SICP. Keep casing pressure constant by using the manual choke.

41. During a Wait and Weight kill operation the choke operator is correctly following the drill pipe pressure schedule. However, the pump operator is running the pump 5 SPM faster than the rate used in the calculations. What is the effect on the bottom pressure?

a. It is too high.
b. It is too low.
c. It is equal to formation pressure.
d. It depends on the location of the influx.

42. Which of the following immediate action would you take if the choke line parted whilst circulating a kick out of the well?

a. Stop pumping and Close the choke.
b. Stop pumping and close BOP choke and kill line valves.
c. Stop pumping and close BOP choke line valve(s).
d. Reverse circulation.
e. Continue pumping at low rate.

43. What will be the increase in bottomhole pressure after pumping an 1.68 slug prior to tripping out of the hole?

a. 7 bar
b. 0 bar
c. Insufficient data to calculate the pressure.
d. 2 bar

44. When a kick has been shut in why is the SICP usually higher than the SIDPP?

a. Because of the difference in capacities of the drill string and annulus.
b. Because drilled gas at the top of the hole reduces the hydrostatic pressure in the annular.
c. Because the influx in usually is less dense than the mud.
d. Because the annulus is loaded with cuttings.
45. What assumption is made in conventional well control, when SIDPP is used to calculate the increase in mud weight required to balance the formation pressure? (Select 3 answers)
   a. The BOP stack will withstand formation pressure.
   b. The drill pipe pressure gauge is accurate.
   c. The casing pressure gauge is accurate.
   d. The choke manifold is tested according to API specifications.
   e. The correct mud weight is known.
   f. The bit is on or near bottom and the drill string is full of mud.

46. What is correct concerning slow circulating rate pressures (SCRs)? (Select 3 answers)
   a. SCRs must be recorded whilst tripping out of hole.
   b. SCRs should be taken after BHA is changed.
   c. SCRs should be taken after mud weight changed
   d. SCRs are not system pressure losses.
   e. SCRs should be taken if there is any appreciable change in depth of the hole.
   f. SCRs should be used to establish pump limit criteria.

47. Whilst a kick/kill operation is in progress the Driller gets tired of waiting for kick to get pumped to surface. He speeds up the pump from 25 SPM to 30 SPM but the choke operator still follows the schedule for the 25 SPM speed. What happens to bottomhole pressure?
   a. Increases.
   b. Stays the same.
   c. Decreases.

48. A kick has been circulated out with the Drillers method and the final circulating pressure (FCP) is 20 bar at a pump speed of 30 SPM. The Driller gets impatient of waiting for the kill mud to reach the surface and he speeds up the pump from 30 SPM to 40 SPM. The choke-operator adjusts the choke and maintains 20 bar on the drill pipe gauge. What happens to bottomhole pressure?
   a. Increases by ............bar.
   b. Stays the same.
   c. Decreases by ............bar.

49. A kicking well is closed in and the SIDPP 27 bar and the SICP 48 bar. Both drill pipe and casing pressure start to increase to 34 bar and 55 bar respectively. Assuming no overbalance, the choke should be operated such that:
   a. SICP is brought back to 48 bar
   b. SIDPP is kept at 34 bar
   c. SIDPP is reduced to 48 bar
   d. SIDPP is maintained at 27 bar
50. Pressure can be expressed as:

a. A hydrostatic column.
b. Weight acting on a unit area.
c. Weight of a liter of fluid.
d. Mass due to gravity.

51. The amount of oil/water volumes in a reservoir formation is a mainly dependent on;

a. Permeability.
b. Formation pressure.
c. Formation porosity.
d. Formation temperature.
e. Formation depth.

52. Which of the following alternatives does not reduce the mud hydrostatic pressure?

a. Lowering the mud weight.
b. Lowering the mud level.
c. Swabbing.
d. Formation cuttings in the mud.
e. Gas cut mud.
f. Mud temperature.

53. A drilling break occurs, you check for flow which is negative. Approximately one hour later the mud returning is gas cut. You check for flow which is negative. What has happened? (Select 2 answers)

a. The well is kicking.
b. A more porous formation has been drilled.
c. Gas increase is due to loss off bottomhole pressure during the flow check
d. A formation with high pressure and temperature has been drilled.
e. Gas is liberated from drilled formation.

54. Kick size will increase with time. What property of the formation will cause the fastest kick?

a. High rock density.
b. High permeability.
c. Low porosity.
d. High clay content.
e. Low sand content.
55. The majority of kicks:
   a. Occur without any warning.
   b. Can be prevented if warnings signs are noted.
   c. Develop into blowouts.
   d. Does not give any detectable warning signs.

56. Trip gas can indicate one of the following -
   a. Mud weight is too heavy.
   b. Mud viscosity is too low.
   c. Possible swabbing during a trip.
   d. Bit nozzles are blocked.

57. What is the effect on bottomhole pressure when circulating compared to a static situation.
   a. Bottomhole pressure is greater.
   b. Bottomhole pressure is lesser.
   c. No change in bottomhole pressure.

58. Which of the following alternatives does not cause abnormal pressures?
   a. An excessive overburden weight.
   b. Formation shut off from normal pressure.
   c. An increase in shale density.
   d. A gas cap effect.
   e. An artesian effect.

59. Which of the following warning signs does not indicate “heaving” shale?
   a. Flow line temperature increase
   b. Torque increase
   c. Decrease in rate of penetration (ROP)
   d. Pipe drag
   e. Pump pressure increase without a stroke increase

60. Should the first tool joint below the Kelly be above or below the rotary table when a well is shut in?
   a. Above.
   b. Below.
61. Which stack working at a maximum of 75% of its rated working pressure would you choose for a well of 4877 m TVD in an area where normal formation pressure will be encountered?

a. A 138 bar BOP.
b. A 207 bar BOP.
c. A 345 bar BOP.
d. A 690 bar BOP.
e. A 1034 bar BOP.

62. You are circulating out a kick. You notice that pump pressure and casing pressure are rising even though the choke is wide open. What is likely to be the problem assuming a constant pump rate?

a. The bit is balled up.
b. A washout has occurred.
c. A bit nozzle is plugged.
d. The choke is blocked.
e. The choke is washed out.

63. You have just run the drill string to the bottom of the well at 3660 m TVD. The well started flowing and it was shut in. SIDDP is zero and SICP is 21 bar. What mud weight increase is needed to balance the formation pressure?

a. 0.04 sg
b. 0.006sg.
c. Not enough information to calculate.

64. Which of the following will result in an increase in the pump pressure at 30 SPM? (Select 2 answers)

a. A washout in the drill string
b. A nozzle washout
c. A decrease in mud weight
d. An increase in drilled depth
e. A "loaded" annulus

65. A salt water kick is being circulated out off a well using the Wait and Weight method. There is no gas associated with the influx. At what time does the maximum choke pressure occur?

a. When the top of the influx reaches the choke.
b. When the top of the influx reaches the casing shoe.
c. When the bottom of the influx passes from the drill collar to the drill pipe annulus.
d. When the influx is in the largest washouts in the open hole.
e. At initial shut in.
66. You have obtained the following data prior to starting a killing operation.

- Shut in drill pipe pressure (SIDP) = 40 bar
- Shut in casing pressure (SICP) = 55 bar
- Initial circulating pressure (ICP) = 50 bar at 30 SPM
- Kill mud weight = 1,53 sg

As soon as the circulation is established and the pump is running at the kill speeds of 30 SPM, the gauge reads as follows:

- Drill pipe pressure = 62 bar
- Casing pressure = 62 bar

What action would you take?

a. Stop the pump, shut in the well and recalculate the kill graph using SCRp = 27 bar at 30 SPM.
b. Stop the pump and shut in the well and switch to pump No.2.
c. Operate the choke and reduce the casing pressure to 55 bar.
d. Operate the choke and reduce drill pipe pressure to 50 bar.

67. You have just started to circulate out a kick with the Drillers method. Drill pipe pressure and pump speed are correct and stable. What is the problem if the drill pipe and casing pressure increases?

a. The choke is washing out.
b. The choke is plugging.
c. A bit nozzle has washed out.
d. A bit nozzle has plugged.

68. You have just started to circulate out a kick with the Drillers method. Drill pipe pressure and pump speed are correct and stable. What has occurred if the drill pipe pressure has increased?

a. The choke is washing out.
b. The choke is plugging.
c. A bit nozzle has washed out.
d. A bit nozzle has plugged.

69. You have just started to circulate out a kick with the Drillers method. Drill pipe pressure and pump speed are correct and stable. What is happening if the choke needs to be opened to maintain drill pipe pressure?

a. The choke is washing out.
b. The choke is plugging.
c. A bit nozzle has washed out.
d. A bit nozzle has plugged.
70. You have just started to circulate out a kick with the Drillers method. Drill pipe pressure and pump speed are correct and stable. What is the problem if drill pipe and casing pressures decreases?

a. The choke is washing out.
b. The choke is plugging.
c. A bit nozzle has washed out.
d. A bit nozzle has plugged.

71. You have just started to circulate out a kick with the Drillers method. Drill pipe pressure and pump speed are correct and stable. What has occurred if the drill pipe pressure has decreased?

a. The choke is washing out.
b. The choke is plugging.
c. A bit nozzle has washed out.
d. A bit nozzle has plugged.

72. Which of the following will decrease pump pressure at constant pump rate whilst killing a well? (Select 2 answers)

a. Plugging of the choke.
b. Hole caves in.
c. Washout in the drill string.
d. Closing the choke.
e. Plugged bit nozzle.
f. Unplugging of a bit nozzle.
g. An increase in drilled depth.
h. A "loaded" annulus.

73. The pump pressure relief valve opens whilst circulating out a kick. What action would you take to secure the well?

a. Change over to pump no. 2
b. Stop pump no. 1 and reset valve
c. Stop pump no. 1, Close the choke and close the Kelly cock.
d. Commence volumetric kill

74. After tripping the first 10 stands out of a well it is observed that the well only has taken approximately half of the expected trip volume. No flow is observed. What would be the safest to do?

a. Continue POOH.
b. Run back to bottom and circulate bottoms up.
c. Shut in the well, check for pressure.
d. Strip back to bottom and circulate through the choke.
75. A well has been shut in on a kick and the casing pressure gauge reads 52 bar. The drill pipe pressure gauge reads 2 bar because of a float in the drill string above the bit. How would you obtain the shut in drill pipe pressure for the kill mud calculations? (Select 2 answers)

a. Calculate the bottomhole pressure by using the pit gain and the SICP. Subtract the hydrostatic pressure in the drill pipe from the bottomhole pressure to obtain the drill pipe pressure for the kill mud calculation.
b. Pump slowly down the drill pipe until the casing pressure gauge flicks. Stop the pump and use the stabilized shut pressure on the drill pipe gauge for the kill mud calculations.
c. Subtract hydrostatic pressure in the drill pipe from the SICP and use the influx density and the pit gain to calculate the drill pipe pressure for the kill mud calculations.
d. Pump down the drill string until SICP increases with some psi. Read the stabilized shut in drill pipe pressure and subtract the pressure increase on the casing pressure gauge to get the pressure for the kill mud calculations.

76. When the whole gas kick is inside the casing we need not to concern ourselves with MAASP based on the formation breakdown pressure, but switch our attention to not exceed casing burst with safety factor.

a. False.
b. Only when the kick is out of the well.
c. True.
d. Depends on API specification of formation pressure.

77. When is it most important to maintain the hole full when tripping out of a well when considering surge and swabbing actions?

a. When pulling the first few stands of bottom.
b. When pulling the drill collars past the casing shoe.
c. When pulling drill collars out of the well.
d. Before starting to pull pipe

78. What are the requirements for a kick to occur? (Select 2 answers)

a. Mud hydrostatic is equal to formation pressure.
b. Mud hydrostatic is greater than formation pressure.
c. Mud hydrostatic is less than formation pressure.
d. High formation porosity:
e. High formation permeability.
f. Zero formation porosity.
g. Zero formation permeability.
79. All of the following are kick warning signs except for:

a. Increase in flow rate out.
b. Pit gain.
c. Drilling break.
d. Lost circulation.
e. Decrease in pump pressure.
f. Decrease in pump rate.

80. A 6000 L kick in a narrow annular is more dangerous because;
(Select 2 answers)

a. It is difficult to calculate kill mud weight.
b. The influx is higher.
c. The kicks are usually gas.
d. The drill string gets stuck.
e. The danger of breaking down the shoe.

81. Reduction in drilling rate can indicate;
(Select 2 answers)

a. An increase in porosity.
b. A decrease in porosity.
c. No change in porosity.
d. An increase in the overbalance.
e. A decrease in the overbalance.
f. No change in the overbalance.

82. You are drilling and notice an increase in drilling rate, a slight toque rise and a small amount of gas in the mud. What action would you take?

a. Carry on. All is OK.
b. Check for flow, if negative pull out of the hole.
c. Check for flow, if negative carry on drilling but watch instruments closely.
d. Pull up, check for flow, if negative, circulate and inform the tool pusher or the company man.

83. Which of the following causes of well kick is totally avoidable and due to lack of alertness by the drill crew?

a. Lost circulation.
b. Gas cut mud.
c. Not keeping hole full.
d. Abnormal pressures.
84. Mud monitoring equipment, such as pit volume indicators, pit alarms, trip tanks and flow indicators should be used:

a. Only when company man insists.
b. Any time the well is open.
c. Only in production and abnormal pressure formations.
d. Only in deep formations.

85. Which of the following conditions are essential for the calculation of an accurate formation strength at the casing shoe?
(Select 3 answers)

a. An accurate working stroke counter.
b. An accurate pressure gauge.
c. Uniform and known mud density.
d. The mud yield point.
e. The vertical depth of casing shoe.

86. The reduction in bottomhole pressure is highest when gas cut mud:

a. Reaches the surface.
b. Reaches the casing shoe.
c. Is at bottom.

87. While drilling a well at 1800 m TVD with a mud density of 1.50 sg and circulating gas cut mud, the following conditions are estimated:

From surface to 200 m - mud density is 1.35 sg.
From 200 m to 400 m - mud density is 1.40 sg.
From 400 m to well TD - mud density is 1.50 sg.

What is the reduction in the bottomhole pressure?

a. 5 bar.
b. 10 bar.
c. 15 bar.

88. What will be the surface to bit circulation time in minutes if the drill string capacity is 15.1 m³, the mud pump capacity is 16.0 liter/stroke and the pump rate is 25 SPM.

Answer: ...........minutes.
89. When is a formation leak-off test carried out?
   a. Immediately before running casing.
   b. Immediately after running and cementing casing.
   c. After WOC and drilling out casing shoe plus some 2 to 5 meter of new hole.
   d. After WOC but immediately before drilling out casing shoe.

90. While drilling a well at 2000 m TVD with a mud weight of 1.33sg, a total loss of circulation occurs. The formation fracture pressure gradient is 0.127 bar/m. How much does the mud level drop in the well?
   a. 48 m.
   b. 53 m.
   c. 69 m.

91. The following well control data are given;
   Slow circulation rate pressure (SCRp) 28 bar at 30 SPM.
   Shut in drill pipe pressure (SIDPP) 54 bar.
   Shut in casing pressure (SICP) 73 bar.
   Circulation is established with the original mud. While the pump is accelerating to 30 SPM, which pressure has to stay constant to maintain a constant bottomhole pressure?
   a. 54 bar on the drill pipe gauge.
   b. 82 bar on the drill pipe gauge.
   c. 73 bar on the casing gauge.
   d. 100 bar on the casing gauge.

92. The following well control data are given;
   Slow circulation rate pressure (SCRp) 28 bar at 30 SPM.
   Shut in drill pipe pressure (SIDPP) 54 bar.
   Shut in casing pressure (SICP) 73 bar.
   Before starting to kill the well there is a complete failure of pumps. Which pressures has to remain constant in order to maintain constant bottomhole pressure when the gas starts to migrate up the hole?
   a. 54 bar on the drill pipe gauge.
   b. 82 bar on the drill pipe gauge.
   c. 73 bar on the casing gauge.
   d. 100 bar on the casing gauge.
93. A lost circulation situation during a well control operation is usually detected by;
   a. Monitoring the return flow in the flow line.
   b. Monitoring the mud volume in the mud tanks.
   c. Monitoring the pump speed indicator.
   d. Monitoring the weight indicator.

94. Select the products most commonly used to prevent the formation of hydrates. (Select 2 answers)
   a. Water.
   b. Glycol.
   c. Bentonite
   d. CMC.
   e. Methanol.

95. A well has been shut in on a kick. Circulation cannot commence due to mechanical problems. Gas is migrating and bottomhole pressure has to be kept constant. In which of the situations below is it required to use the volumetric method of well control? (Select 2 answers)
   a. When the bit is on bottom without any non-return valve (float) installed above the bit.
   b. When the bit is a long way off bottom without any non-return valve (float) above the bit.
   c. When the bit is on bottom with a non-return valve (float) installed above the bit.
   d. When the bit is on bottom and the non-return valve (float) and the bit is plugged.

96. A well has been shut in with a shut in drill pipe pressure (SIDPP) of 25 bar. Once the circulation has been established at a stable pumping speed of 30 SPM the initial circulating pressure (ICP) observed on the drill pipe gauge is 58 bar. What is the slow circulating rate pressure (SCRp) at 30 SPM?
   a. 25 bar.
   b. 28 bar.
   c. 33 bar.
   d. 36 bar.

97. A kick is circulated out with the Wait and Weight method. FCP is 30 bar at 30 SPM. What should be the pressure reading on the drill pipe gauge if the pump rate is increased to 40 SPM?
   a. 29 bar.
   b. 44 bar.
   c. 50 bar.
   d. 53 bar.
98. A gas kick is being correctly circulated out by holding the bottomhole pressure steady. What will be the variation in the pressure at the casing shoe while the gas kick is circulated past the casing shoe?

   a. The pressure increases when the gas kick is circulated into the casing shoe.
   b. The pressure decreases when the gas kick is circulated into the casing shoe.
   c. The pressure stays roughly steady when the gas kick is circulated into the casing shoe.

99. A gas kick is being correctly circulated out by holding the bottomhole pressure steady. What will be the variation in the pressure at the casing shoe when the kick is inside the casing and above the casing shoe?

   a. The pressure increases until the gas reaches surface.
   b. The pressure decreases as the gas approaches surface.
   c. The pressure stay roughly steady while gas reaches surface.

100. When drilling at 4400 m TVD with 1,80 sg mud, the annular pressure loss is estimated to be 15 bar. What is the equivalent circulating density (ECD)?

   a. 1,81 sg
   b. 1,83 sg
   c. 1,87 sg
   d. 1,91 sg

101. Prior to starting out of the hole at 1737 m TVD with 1,22 sg mud, a slug is pumped in order to pull dry pipe. The well flows due to the tubing effect, but it seems to be flowing a little longer than expected. What should be done?

   a. Forget about it and come on out of the hole. A possible kick will be detected soon enough.
   b. Observe the well for a few seconds more. If worried, shut the well in and check for pressures.
   c. Pit gain expected from slug should have been calculated. If the increase is greater, shut the well in and check for pressure.
   d. Pull 25 stands and check for flow. If no flow, pull out of the hole.

102. For a soft shut in, the choke manifold should be set up as follows while drilling;

   a. BOP choke line valve(s) closed; choke line open to poor boy degasser, remote adjustable choke closed.
   b. BOP choke line valve(s) closed; choke line open to poor boy degasser, manual operated choke closed.
   c. BOP choke line valve(s) closed; choke line open to poor boy degasser, remote adjustable choke open.
   d. BOP choke line valve(s) open; choke line open to poor boy degasser, remote adjustable choke open.
103. What is the correct sequence for closing a well in with the soft shut in procedure?

   a. Pick up the Kelly, shut down the pump and close the BOP, open choke and record pressures.
   b. Shut the pump down, pick up the Kelly, open choke, close BOP, record pressures.
   c. Pick up off bottom, shut down pumps, open BOP choke line valve(s), and close BOP, Close the choke, record pressures.
   d. Pick up Kelly, shut down pump, open the BOP choke line valve(s) and choke, close BOP, close BOP choke line valve(s) and record pressures.

104. When tripping into a well it starts to flow. What is the correct sequence for closing a well in with the hard shut in procedure?

   a. Stab inside BOP and close it, open BOP choke line valve(s), close BOP, Close the choke and record pressures.
   b. Close the BOP, stab inside BOP and close it, open BOP choke line valve(s), Close the choke and record pressures.
   c. Open choke, stab inside BOP and close it, close BOP, open BOP choke line valve(s), Close the choke, record pressures.
   d. Stab inside BOP and close it, close BOP, open BOP choke line valve(s), record casing pressures against closed choke.
   e. Stab inside BOP, close the choke, open choke line valve(s), close the inside BOP and record pressures.

105. During drilling the well kicked and was shut in. While waiting for the on the company supervisor both drill pipe and annulus pressures started to rise. What type of influx would you guess had entered the wellbore?

   a. Fresh water.
   b. Salt water.
   c. Oil.
   d. Dry gas.

106. If the initial closed in drill pipe pressure (SIDPP) was 18 bar and the shut in casing pressure (SICP) was 35 bar, and the pressures started increasing close to the maximum allowable values, what should be done?

   a. Bleed off through the choke and keep 35 bar on drill pipe pressure gauge.
   b. Bleed off through the choke and keep 35 bar on the casing pressure gauge.
   c. Bleed off through the choke and keep 18 bar plus a few psi safety margin on drill pipe pressure gauge.
   d. Bleed off through the choke and keep 18 bar on drill pipe pressure gauge.
107. Which of the following alternatives is usually the main limiting factor in determining maximum allowable annular surface pressure (MAASP)?

   a. The maximum pressure the BOP will withstand.
   b. The maximum pressure that the casing will withstand.
   c. The maximum pressure that the formation below the casing shoe will withstand.

108. Having completed the first circulation of the Drillers method, the well is shut in. What should the casing pressure be?

   a. Greater than the initial shut in drill pipe pressure.
   b. Equal to the initial shut in drill pipe pressure.
   c. Less than the initial shut in drill pipe pressure.

109. A well with depth 2850 m TVD is filled with 1.26 sg mud. Open ended drill pipe is run into the well to 1783 m and the 1.26 sg mud is displaced out with 1.01 sg drill water. What is the reduction in the bottomhole pressure as a result of the displacement?

   Answer: ........... bar.

110. During drilling an increase in connection gas is detected. What action is needed?

   (Select 2 answers)

   a. Circulate bottoms up before making the next connection.
   b. Pump a low viscosity mud pill to clean a balled up bit.
   c. Pump a high viscosity mud pill to clean the hole.
   d. Reduce connection time to a minimum.
   e. Increase the yield point of the mud.

111. When circulating out a kick a washout is detected in the drill string. Choose one of the following actions.

   a. Continue circulation.
   b. Increase the pump rate and continue circulation.
   c. Use the volumetric method until the influx is above the washout, continue circulating.

112. A gas kick is circulated out with the Drillers method. How should the drill crew act when the gas influx enters the choke line?

   a. The choke should be opened.
   b. The pump rate should be reduced.
   c. The choke should be closed (a little).
   d. The choke opening should not be changed.
113. When should it be considered to update and record slow circulating rate pressure (SCRp) data? (Select 3 answers)

a. Prior to drilling out of a casing shoe.
b. At the beginning of every crew change.
c. When the mud weight is changed.
d. Prior to running the casing.

114. What should be done in a drilling situation when total loss of circulation occurs?

a. Pump lost circulation materials immediately.
b. Pump a cement slug down the annulus.
c. Pump a heavy mud volume down the kill line into the annulus.
d. Top up the well with drill water and record the volume used.

115. Which of the following situation in a well will increase the danger of exceeding the MAASP value? (Select 3 answers)

a. A short open hole section.
b. A small difference between the fracture gradient and the mud hydrostatic pressure.
c. A small kick influx.
d. A long section of open hole.
e. A large difference between the fracture gradient and the mud hydrostatic pressure.
f. A large kick influx.

116. How should the expression MAASP be defined or described?

a. The total pressure at the casing shoe that can result in mud losses.
b. The pressure that can be applied in addition to the mud column without losing mud or bursting the casing.
c. The additional pressure that can be applied to the drill pipe pressure when circulating out a kick.
d. The maximum allowable bottomhole pressure when circulating out a kick.

117. What is the primary drilling operation factor or action to prevent a well kick to occur?

a. Activate the BOP to close the well in case an under balance situation develops.
b. Use the slow circulating rate pressure (SCRp) to regain a balanced situation in the well.
c. Use the mud hydrostatic pressure to control the formation pore pressure.
d. Use the flow meter in the flow line and the pit level instruments to detect an influx.
118. When drilling with constant rate for some time it observed that the shakers start to overload with cuttings. What would be the safest way to solve a possible well problem?

a. Reduce the pump rate until the shakers can cope with the excessive amount of cuttings.
b. Continue with the same pump rate and let the excessive cuttings overflow into the sand trap for dumping at a later stage.
c. Reduce the pump rate and the drilling rate sufficiently until the shakes take properly care of the amount of cutting. Then continue with the original drilling parameters.
d. Pull off bottom and make a flow check. If well is stable circulate bottoms up with reduced circulating rate with no overflow on the shakers. Make flow checks a few times while circulating the well clean.

119. Which of the statements below are regarded as good oil field practices when drill top holes where shallow gas sands can be encountered? (Select 2 answers)

a. Use high mud weight to create maximum overbalance.
b. Limit drilling to a low rate of penetration.
c. Pump at regular intervals a high viscosity pill to clean the hole for cuttings.
d. Circulate while pulling out of the hole.
e. Use high rate of penetration to increase the mud viscosity.

120. Which of the conditions will probably result in swabbing? (Select 3 answers)

a. Circulate while pulling out of the hole.
b. Use a mud wit high viscosity.
c. Pull the drill string through tight spots without circulating.
d. Pull out of hole with high speed.
e. Pull the drill string through tight spots while circulating.
f. Pull slowly out of the hole
02. Pressure gauge exercises

02.01. Drillers method Subsea

Situation 1:

Use the information and the killsheet to answer the questions in the following situations.

The well to be killed with Driller’s method with a pump rate at 30Spm
### Sub Sea BOP Kill Sheet - Deviated well (Metric/Bar)

#### FORMATION STRENGTH DATA

<table>
<thead>
<tr>
<th>Surface Lot-Off Pressure from formation strength test</th>
<th>(A) 50 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling fluid density at test</td>
<td>(B) 1,38 sg</td>
</tr>
</tbody>
</table>

Max. Allowable Drilling fluid density = (B) + \( \frac{A_l}{\text{Shoe T.V. Depth} \times 0.0981} \) = (C) 1,85 sg

Initial MAASP = (C) - Current density) \( \times \) Shoe TVD \( \times \) 0.0981 = 36 bar

#### CURRENT WELL DATA

| KOP MD | 700 m |
| KOP TVD | 700 m |
| EOB MD | 1120 m |

#### Slow pump Rate Data

<table>
<thead>
<tr>
<th>Pump no I</th>
<th>Pump no II</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(\text{mure} )</td>
<td>P(\text{ndp} )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>20 SPM</th>
<th>30 SPM</th>
<th>40 SPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>( l ) stroke</td>
<td>( l' ) stroke</td>
<td>( l' ) stroke</td>
</tr>
</tbody>
</table>

#### Casing Shoe Data

| Size | 9.5/8 in |
| M. Depth | 1340 m |

#### Slow pump Rate Data

<table>
<thead>
<tr>
<th>Pump no I</th>
<th>Pump no II</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(\text{mure} )</td>
<td>P(\text{ndp} )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>20 SPM</th>
<th>30 SPM</th>
<th>40 SPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>32</td>
<td>11</td>
</tr>
<tr>
<td>( \text{bar} )</td>
<td>( \text{bar} )</td>
<td>( \text{bar} )</td>
</tr>
</tbody>
</table>

#### Hole data

| M. Depth | 2541 m |
| T.V. Depth | 1400 m |

#### Directional Data

| 16.8 | 23.3 |

#### Pre-recorded Volume data

<table>
<thead>
<tr>
<th>Length</th>
<th>Capacity</th>
<th>Volume</th>
<th>Pump Strokes</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>m</td>
<td>liters/ m</td>
<td>liters</td>
<td>Stks</td>
<td>Minutes</td>
</tr>
<tr>
<td>DP- surface to KOP</td>
<td>700 x 8.97</td>
<td>6279 + (L)</td>
<td>392 stks</td>
<td>45 min</td>
</tr>
<tr>
<td>DP- KOP to EOB</td>
<td>420 x 8.97</td>
<td>3767 + (M)</td>
<td>235 stks</td>
<td>40 min</td>
</tr>
<tr>
<td>DP- EOB to BHA</td>
<td>1135 x 8.97</td>
<td>10181 + (N1)</td>
<td>636 stks</td>
<td>45 min</td>
</tr>
<tr>
<td>Heavy Wall Drill Pipe</td>
<td>112 x 4.61</td>
<td>516 + (N2)</td>
<td>32 stks</td>
<td>30 min</td>
</tr>
<tr>
<td>Drill Collars</td>
<td>174 x 4.01</td>
<td>698 + (N3)</td>
<td>44 stks</td>
<td>35 min</td>
</tr>
<tr>
<td>DC x Open Hole</td>
<td>174 x 16.8</td>
<td>2923 + (L)</td>
<td>170 stks</td>
<td>30 min</td>
</tr>
<tr>
<td>DP/ HWDP x Open Hole</td>
<td>1027 x 23.3</td>
<td>23925 + (L)</td>
<td>1360 stks</td>
<td>90 min</td>
</tr>
<tr>
<td>Open Hole volume</td>
<td>( k )</td>
<td>26858 liters</td>
<td>1678 stks</td>
<td>56 min</td>
</tr>
<tr>
<td>DP x Cased Hole</td>
<td>1152 x 23.6</td>
<td>27187 liters</td>
<td>1699 stks</td>
<td>57 min</td>
</tr>
<tr>
<td>Choke Line</td>
<td>200 x 3.2</td>
<td>640 liters</td>
<td>40 stks</td>
<td>1 min</td>
</tr>
<tr>
<td>Total Annulus volume</td>
<td>( \text{K} + \text{J} )</td>
<td>54688 liters</td>
<td>3417 stks</td>
<td>114 min</td>
</tr>
<tr>
<td>Total Well System Volume</td>
<td>( \text{D} + \text{I} + \text{J} )</td>
<td>76121 liters</td>
<td>4758 stks</td>
<td>159 min</td>
</tr>
<tr>
<td>Active Surface Volume</td>
<td>( \text{K} )</td>
<td>1866 liters</td>
<td>116 stks</td>
<td></td>
</tr>
<tr>
<td>Total Active Fluid System</td>
<td>( \text{J} + \text{K} )</td>
<td>7798 liters</td>
<td>4874 stks</td>
<td></td>
</tr>
<tr>
<td>Marine Riser x DP</td>
<td>188 x 188.5</td>
<td>35438 liters</td>
<td>2215 stks</td>
<td></td>
</tr>
</tbody>
</table>
### Kick Data

<table>
<thead>
<tr>
<th>SIDPP</th>
<th>24 bar</th>
<th>SICP</th>
<th>33 bar</th>
<th>Pit Gain</th>
<th>4700 liters</th>
</tr>
</thead>
</table>

**Kill Fluid Density**

\[
\text{Current Drilling Fluid Density} = \frac{\text{SIDPP}}{\text{TVD} \times 0.0981}
\]

**KMD**

\[
1.52 + \frac{24}{1400} = 1.70 \text{ sg}
\]

**Initial Circulating Pressure**

\[
\text{ICP} = \text{SIDPP} + \text{Dynamic pressure loss}
\]

\[
\text{ICP} = 21 + 24 = 45 \text{ bar}
\]

**Final Circulating Pressure**

\[
\text{FCP} = \frac{\text{Kill Fluid density}}{\text{Current Drilling Fluid Density}} \times \text{Dynamic Pressure loss}
\]

\[
\text{FCP} = 1.70 \times 21 = 23.5 \text{ bar}
\]

**Initial Dynamic Casing Pressure at Kill pump rate**

\[
\text{SICP} - \text{CFL}
\]

\[
33 - 11 = 22.0 \text{ bar}
\]

**Dynamic Pressure loss at KOP point (O)**

\[
\text{PL} = \left( \text{FCP} - \text{PL} \right) \times \frac{\text{KMD}}{\text{TVD}}
\]

\[
\text{PL} = 22.0 \times 100 = 22.0 \text{ bar}
\]

**Raimaining SIDPP at KOP point (P)**

\[
\text{SIDPP} - \left( \left( \text{KMD} \times \text{KOP TVD} \right) \times 0.0981 \times \text{KOP TVD} \right)
\]

\[
24 - \left( 1.70 - 1.52 \right) \times 0.0981 \times 700 = 11.6 \text{ bar}
\]

**Circ Pressure at KOP (KOP CP)**

\[
\text{O} + \text{P} = 21.69 + 11.64 = 33.3 \text{ bar}
\]

**Dynamic Pressure loss at EOB point (R)**

\[
\text{PL} = \left( \text{EOB TVD} \times \frac{\text{KMD}}{\text{TVD}} \right) \times \left( \text{FCP} - \text{PL} \right)
\]

\[
\text{PL} = 22.1 \text{ bar}
\]

**Raimaining SIDPP at EOB point (S)**

\[
\text{SIDPP} - \left( \left( \text{KMD} \times \text{EOB TVD} \right) \times 0.0981 \times \text{EOB TVD} \right)
\]

\[
24 - \left( 1.70 - 1.52 \right) \times 0.0981 \times 1030 = 5.8 \text{ bar}
\]

**Circ Pressure at EOB (EOB CP)**

\[
\text{R} + \text{S} = 22.10 + 5.81 = 27.9 \text{ bar}
\]

**T**

\[
\text{ICP} - \text{KOP CP} = \left( 45 - 33.32 \right) = 11.68 \text{ bar}
\]

\[
\frac{11.68 \times 100}{392} = 3.0 \text{ bar} \times 100 \text{ strokes}
\]

**U**

\[
\text{KOP CP} - \text{EOB CP} = \left( 33.32 - 27.91 \right) = 5.42 \text{ bar}
\]

\[
\frac{5.42 \times 100}{235} = 2.3 \text{ bar} \times 100 \text{ strokes}
\]

**W**

\[
\text{EOB CP} - \text{FCP} = \left( 27.91 - 23.5 \right) = 4.42 \text{ bar}
\]

\[
\frac{4.42 \times 100}{712} = 0.62 \text{ bar} \times 100 \text{ strokes}
\]
Sub Sea BOP Kill Sheet - Deviated well (Metric/bar)

<table>
<thead>
<tr>
<th>Stroke</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>45,0</td>
</tr>
<tr>
<td>100</td>
<td>42,0</td>
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<tr>
<td>200</td>
<td>39,0</td>
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<tr>
<td>300</td>
<td>36,1</td>
</tr>
<tr>
<td>400</td>
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<tr>
<td>1340</td>
<td>23,5</td>
</tr>
<tr>
<td>1440</td>
<td>23,5</td>
</tr>
</tbody>
</table>

Dynamic Kill graph
Situation 2:

After pumping 39 strokes, the pressure shows the following values at the choke panel:

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Increase pump rate
D: Reduce pump rate
E: Continue – all ok
Situation 3:

After pumping 217 strokes, the pressure shows the following values at the choke panel:

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Increase pump rate
D: Reduce pump rate
E: Continue – all ok
Situation 4:

After pumping 327 strokes, the pressure shows the following values at the choke panel:

What actions need to be taken?

A: Open the choke  
B: Close the choke  
C: Increase pump rate  
D: Reduce pump rate  
E: Continue – all ok
Situation 5:

After pumping 383 strokes, the pressure shows the following values at the choke panel:

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Increase pump rate
D: Reduce pump rate
E: Continue – all ok
Situation 6:

After pumping 2760 strokes, the pressure shows the following values at the choke panel:

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Increase pump rate
D: Reduce pump rate
E: Continue – all ok
Situation 7:

After pumping 3500 strokes, the well is closed to check if everything is ok. The pressure shows the following values at the choke panel. After the check the kill operation continues.

What actions need to be taken?

A: Wrong method was used when the well was shut in
B: Well kick is circulated
C: Well kick is not circulated properly
D: The pressure gauge shows the wrong value
Situation 8:

After pumping 4760 strokes, the pressure shows the following values at the choke panel:

What is wrong, and what actions need to be taken?

A: Open the choke
B: Close the choke
C: Increase pump rate
D: Reduce pump rate
E: Continue – all ok
Situation 9:

After pumping 600 strokes, the pressure shows the following values at the choke panel:

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Increase pump rate
D: Reduce pump rate
E: Continue – all ok
Situation 10:

After pumping 1350 strokes, the pressure shows the following values at the choke panel:

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Increase pump rate
D: Reduce pump rate
E: Continue – all ok
Situation 11:

After pumping 4867 strokes, the pressure shows the following values at the choke panel:

What is the situation and what actions need to be taken?

A: Reduce pump speed
B: Increase pump speed
C: Reduce the choke valve opening
D: Increase the choke valve opening
E: Continue – all ok
02.02. Wait and weight method subsea

Situation 1:

Use the information and the killsheet to answer the questions in the following situations.

The well to be killed using W&W, kill rate 30 Spm.
### FORMATION STRENGTH DATA

- **Surface Lot-Off Pressure from** formation test: 50 bar
- **Drilling fluid density at test** (B) = 1.38 sg
- Max. Allowable Drilling fluid density = (A) / Shoe T.V.D. x 0.0981 = (C) 1.85 sg

Initial MAASP = (C) - Current density) x Shoe TVD x 0.0981

### CURRENT WELL DATA

- **Current Drilling Fluid** Density = 1.52 sg
- **Sub Sea BOP Data**
  - Marine Riser Length: 188 m
  - Choke Line Length: 200 m
- **Directional Data**
  - KOP MD: 700 m
  - KOP TVD: 700 m
  - EOB MD: 1120 m
  - EOB TVD: 1030 m

<table>
<thead>
<tr>
<th>Slow pump</th>
<th>Pump no. I Displ.</th>
<th>Pump no. II Displ.</th>
<th>(P_{\text{line}} - P_{\text{line}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 SPM</td>
<td>16 l/stroke</td>
<td>16 l/stroke</td>
<td></td>
</tr>
<tr>
<td>30 SPM</td>
<td>21 32</td>
<td>21 32</td>
<td></td>
</tr>
<tr>
<td>40 SPM</td>
<td>11 bar</td>
<td>11 bar</td>
<td></td>
</tr>
</tbody>
</table>

- **ChokeLine friction**
  - (PL) Dynamic pressure loss (bar)

- **Capacity**
  - (F+G+H)=(I)
  - (D+I)=(J)
  - (K)

<table>
<thead>
<tr>
<th><strong>3,2</strong></th>
<th><strong>1,85</strong></th>
<th><strong>8,97</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>liters/m</td>
<td>liters/m</td>
<td>liters/m</td>
</tr>
</tbody>
</table>

### Casing Shoe Data

- **Size** 9 5/8 in
- **M. Depth** 1340 m
- **T.V. Depth** 1100 m

### Slow pump data

<table>
<thead>
<tr>
<th>Rate Data</th>
<th>Pump no. I</th>
<th>Pump no. II</th>
<th>(P_{\text{line}} - P_{\text{line}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 SPM</td>
<td>16 l/stroke</td>
<td>16 l/stroke</td>
<td></td>
</tr>
<tr>
<td>30 SPM</td>
<td>21 32</td>
<td>21 32</td>
<td></td>
</tr>
<tr>
<td>40 SPM</td>
<td>11 bar</td>
<td>11 bar</td>
<td></td>
</tr>
</tbody>
</table>

### Hole data

- **Size** 8 1/2 in
- **M. Depth** 2541 m
- **T.V. Depth** 1400 m

### Pre-recorded data

<table>
<thead>
<tr>
<th>Volume data</th>
<th>Length</th>
<th>Capacity</th>
<th>Volume</th>
<th>Pump Strokes</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>m</td>
<td>liters</td>
<td>liters</td>
<td>Stks</td>
<td>Minutes</td>
<td></td>
</tr>
<tr>
<td>DP- surface to KOP</td>
<td>700 x 8.97</td>
<td>6279 +</td>
<td>(L) 392</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP-KOP to EOB</td>
<td>420 x 8.97</td>
<td>3767 +</td>
<td>(M) 235</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP- EOB to BHA</td>
<td>1135 x 8.97</td>
<td>10181 +</td>
<td>(N1) 636</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy Wall Drill Pipe</td>
<td>112 x 4.61</td>
<td>516 +</td>
<td>(N2) 32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drill Collars</td>
<td>174 x 4.01</td>
<td>698 +</td>
<td>(N3) 44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drill String Volume</td>
<td>x (D)</td>
<td>21441 (E)</td>
<td>1340 stks</td>
<td>45 min</td>
<td></td>
</tr>
</tbody>
</table>

| DC x Open Hole   | 174 x 16.8 | 2923 | |
| DP x HWDP x Open Hole | 1027 x 23.3 | 23929 | |

| Open Hole volume | x (F) | 26852 liters | 1678 stks | 56 min |
| DP x Cased Hole  | 1152 x 23.6 | 27187 liters | 1699 stks | 57 min |

| ChokeLine        | x 3.2 | 640 liters | 40 stks | 1 min |

| Total Annulus volume | (F+G+H)=(I) | 54680 liters | 3417 stks | 114 min |
| Total Well System Volume | (D+I)=(J) | 76121 liters | 4758 stks | 159 min |
| Active Surface Volume | (K) | 1860 liters | 116 stks | |
| Total Active Fluid System | (J+K) | 77981 liters | 4874 stks | |
| Marine Riser x DP  | 188 x 188.5 | 35438 liters | 2215 stks | |
Sub Sea BOP Kill Sheet - Deviated well (Metric/Bar)

Kick Data

<table>
<thead>
<tr>
<th>SIDPP</th>
<th>24 bar</th>
<th>SICP</th>
<th>33 bar</th>
<th>Pit Gain</th>
<th>4700 liters</th>
</tr>
</thead>
</table>

Kill Fluid Density

Current Drilling Fluid Density + \( \frac{\text{SIDPP} \times \text{KMD}}{\text{TVD} \times 0.0981} \)

\[ \text{KMD} = \frac{1.52 + \frac{24}{1400 \times 0.0981}}{22.0 \text{ bar}} = 1.70 \text{ sg} \]

Initial Circulating Pressure

Dynamic pressure loss + SIDPP

\[ \text{ICP} = 21 + 24 = 45 \text{ bar} \]

Final Circulating Pressure

Kill Fluid density \times \text{Current Drilling Fluid Density} = 23.5 \text{ bar} \]

Initial Dynamic Casing Pressure at Kill pump rate

\[ \text{SICP} - \text{CFL} = 22.0 \text{ bar} \]

Dynamic Pressure loss at KOP point (O)

\[ \frac{\text{PL} \times (\text{FCP} - \text{PL})}{\text{TVD}} \]

\[ \text{KOP MD} = 21.7 \text{ bar} \]

Raimaining SIDPP at KOP point (P)

SIDPP - \( (\text{KMD} - \text{OMD}) \times 0.0981 \times \text{KOP TVD} \)

\[ \text{KOP point (P)} = 11.6 \text{ bar} \]

Circ Pressure at KOP (KOP CP)

\[ O + P = 21.69 + 11.64 = 33.3 \text{ bar} \]

Dynamic Pressure loss at EOB point (R)

\[ \frac{\text{PL} \times (\text{FCP} - \text{PL})}{\text{EOB MD}} \]

\[ 27.9 \text{ bar} \]

Raimaining SIDPP at EOB point (S)

SIDPP - \( (\text{KMD} - \text{OMD}) \times 0.0981 \times \text{EOB TVD} \)

\[ \text{EOB point (S)} = 5.8 \text{ bar} \]

Circ Pressure at EOB (EOB CP)

\[ R + S = 22.10 + 5.81 = 27.9 \text{ bar} \]

(T) = \( \frac{\text{ICP} \times 100}{\text{L}} \)

\[ \text{L} = 3.0 \text{ bar} \]

(U) = \( \frac{\text{KOP CP} \times 100}{\text{M}} \)

\[ \text{M} = 2.3 \text{ bar} \]

(W) = \( \frac{\text{EOB CP} \times 100}{\text{N1+N2+N3}} \)

\[ \text{N1+N2+N3} = 0.62 \text{ bar} \]
Sub Sea BOP Kill Sheet - Deviated well (Metric/bar)

<table>
<thead>
<tr>
<th>Stroke</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>45.0</td>
</tr>
<tr>
<td>100</td>
<td>42.0</td>
</tr>
<tr>
<td>200</td>
<td>39.0</td>
</tr>
<tr>
<td>300</td>
<td>36.1</td>
</tr>
<tr>
<td>400</td>
<td>33.1</td>
</tr>
<tr>
<td>500</td>
<td>30.8</td>
</tr>
<tr>
<td>600</td>
<td>28.5</td>
</tr>
<tr>
<td>700</td>
<td>27.5</td>
</tr>
<tr>
<td>800</td>
<td>26.9</td>
</tr>
<tr>
<td>900</td>
<td>26.2</td>
</tr>
<tr>
<td>1000</td>
<td>25.6</td>
</tr>
<tr>
<td>1100</td>
<td>25.0</td>
</tr>
<tr>
<td>1200</td>
<td>24.3</td>
</tr>
<tr>
<td>1300</td>
<td>23.7</td>
</tr>
<tr>
<td>1340</td>
<td>23.5</td>
</tr>
<tr>
<td>1440</td>
<td>23.5</td>
</tr>
</tbody>
</table>

Dynamic Kill graph

![Graph showing the relationship between stroke and pressure for a deviated well.](image-url)
Situation 2:

After pumping 60 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke  
B: Close the choke  
C: Reduce pump rate  
D: Increase pump rate  
E: Continue – all ok
Situation 3:

After pumping 210 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 4:

After pumping 300 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 5:

After pumping 1200 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke  
B: Close the choke  
C: Reduce pump rate  
D: Increase pump rate  
E: Continue – all ok
Situation 6:

After pumping 1350 strokes, the well was shut in and the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Start up holding Csg pressure constant.

B: Start up with 30Spm and keep the last observed circulation pressures

C: Start circulating by reducing the casing pressure by choke line friction, while increasing the pumps to kill rate.

D: The casing pressure is too high due to the kill mud entering open hole. Adjust for killmud density
Situation 7:

After pumping 3235 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 8:

After pumping 3892 strokes, vibrations in Kelly hose is observed and the pump pressure is varied and dropping.

**A: What is the problem?**

**A:** A washed out nozzle in the bit  
**B:** A washout in the mud pump  
**C:** A plugged nozzle in the bit  
**D:** Pump problems  
**E:** A washed out choke
B: What actions need to be taken?

A: Stop the pump and close the well. Isolate the pump. Change pump and start circulation with the parameters recorded before the incident.

B: Stop the pump and close the well. Start up using constant casing pressure

C: Reduce the pump rate to reduce the casing pressure

D: Increase the pump rate

E: Open the choke
Situation 9:

Establishing circulation was ok, and the following pressure value was recorded on the gauges.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 10:

After pumping 4563 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke  
B: Close the choke  
C: Reduce pump rate  
D: Increase pump rate  
E: Continue – all ok
Situation 11:

After pumping 4800 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Close the choke
B: Open BOP and start drilling
C: Stop pump, close well and observe pressures
D: Open the choke
E: All ok, stop pump, close and check well
02.03. Drillers method surface

Situation 1:

Use the information and the killsheet to answer the questions in the following situations.

By using driller’s method, the well should be killed at a kill rate of 35 Spm.
### Surface Lot-Off Pressure from

<table>
<thead>
<tr>
<th>Current drilling fluid</th>
<th>(A)</th>
<th>bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling fluid density at test</td>
<td>(B)</td>
<td>sg</td>
</tr>
<tr>
<td>Max. Allowable Drilling fluid density</td>
<td>=</td>
<td>(C) sg</td>
</tr>
<tr>
<td>(B) + (A) Shoe T.V. Depth x 0.0981</td>
<td>=</td>
<td>(C) sg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initial MAASP</th>
<th>Size</th>
<th>9 5/8 in</th>
</tr>
</thead>
<tbody>
<tr>
<td>(C) - Current density x Shoe TVD x 0.0981</td>
<td>M. Depth</td>
<td>2800 m</td>
</tr>
<tr>
<td></td>
<td>T.V. Depth</td>
<td>2700 m</td>
</tr>
</tbody>
</table>

#### Slow pump Rate Data

<table>
<thead>
<tr>
<th>Pump no I Displ</th>
<th>Pump no II Displ</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.01 l/stroke</td>
<td>16.01 l/stroke</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Slow pump Rate Data</th>
<th>Pump no I</th>
<th>Pump no II</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 SPM</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>35 SPM</td>
<td>48</td>
<td>48</td>
</tr>
</tbody>
</table>

#### Pre-recorded Volume data

<table>
<thead>
<tr>
<th>Volume data</th>
<th>Length</th>
<th>Capacity</th>
<th>Volume</th>
<th>Pump Strokes</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>m</td>
<td>l/m</td>
<td>Liters</td>
<td>Stks</td>
<td>Minutes</td>
<td></td>
</tr>
<tr>
<td>Drill Pipe</td>
<td>x</td>
<td>=</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy Wall Drill Pipe</td>
<td>x</td>
<td>=</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drill Collars</td>
<td>x</td>
<td>=</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drill String Volume</td>
<td>x</td>
<td>(D)</td>
<td>(E)</td>
<td>2143 stks</td>
<td>61.2 min</td>
</tr>
<tr>
<td>DC x Open Hole</td>
<td>x</td>
<td>=</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP/HWDP x Open Hole</td>
<td>x</td>
<td>=</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Hole volume</td>
<td>x</td>
<td>(F)</td>
<td>Liters</td>
<td>1572 stks</td>
<td>45 min</td>
</tr>
<tr>
<td>DP x Cased Hole</td>
<td>x</td>
<td>(G)</td>
<td>stks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Annulus volume</td>
<td>(F+G)=H</td>
<td>Liters</td>
<td>6342 stks</td>
<td>181.2 min</td>
<td></td>
</tr>
<tr>
<td>Total Well System Volume</td>
<td>(D+H)=(I)</td>
<td>Liters</td>
<td>8485 stks</td>
<td>242.4 min</td>
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</tr>
</tbody>
</table>

#### Active Surface Volume

<table>
<thead>
<tr>
<th>Active Surface Volume</th>
<th>(J)</th>
<th>Liters</th>
<th>stks</th>
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</thead>
</table>

#### Total Active Fluid System

<table>
<thead>
<tr>
<th>Total Active Fluid System</th>
<th>(I+J)</th>
<th>Liters</th>
<th>stks</th>
</tr>
</thead>
</table>
Surface BOP Kill Sheet - Vertical well (Metric/Bar)

**Kick Data**

<table>
<thead>
<tr>
<th>SIDPP</th>
<th>SICP</th>
<th>Pit Gain</th>
<th>Liters</th>
</tr>
</thead>
<tbody>
<tr>
<td>34 bar</td>
<td>48 bar</td>
<td>2000</td>
<td>liters</td>
</tr>
</tbody>
</table>

**Kill Fluid Density**

\[ \text{KMD} = \text{Current Drilling Fluid Density} + \frac{\text{SIDPP}}{\text{TVD} \times 0.0981} \]

\[ \text{KMD} = 1.44 + \frac{34}{3820 \times 0.0981} = 1.53 \text{ sg} \]

**Initial Circulating Pressure**

\[ \text{ICP} = 28 + 34 = 62 \text{ bar} \]

**Final Circulating Pressure**

\[ \text{FCP} = 1.06 \times 28 = 30 \text{ bar} \]

\[ (K) = \text{ICP} \times \text{FCP} \times \frac{(K) \times 100}{(E)} = 1.50 \text{ bar/100 stks} \]

<table>
<thead>
<tr>
<th>Stroke</th>
<th>Pressure (bar)</th>
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<tbody>
<tr>
<td>0</td>
<td>62</td>
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<tr>
<td>100</td>
<td>61</td>
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<tr>
<td>200</td>
<td>59</td>
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<td>300</td>
<td>58</td>
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<td>400</td>
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<td>1900</td>
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<td>32</td>
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<tr>
<td>2100</td>
<td>31</td>
</tr>
<tr>
<td>2143</td>
<td>30</td>
</tr>
</tbody>
</table>

**Graph**

- **Pressure (bar)**
  - 65 - 25
  - 60 - 35
  - 55 - 30
  - 50 - 25
  - 45 - 20
  - 40 - 15
  - 35 - 10
  - 30 - 5
  - 25 - 0

- **Strokes**
  - 0 - 2500
Situation 2:

After pumping 20 strokes, the pressure shows the following values on the choke panel.

What is the first action that should be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 3:

After pumping 65 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 4:

After pumping 180 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 5:

After pumping 5987 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 6:

After pumping 6587 strokes, the well is closed in to check. The pressure shows the following values on the choke panel.

What is wrong?

A: Choke gauge is showing wrong value
B: Plugged choke
C: The kick is not circulated out of the well
D: Well is not shut in correct. Pressure trapped.
Situation 7:

After pumping 6954 strokes, a pressure increase on Dp pressure is recorded. The Csg pressure is unchanged.

**A: What is the problem?**

A: A washed out nozzle in bit
B: A wash out in the drill string
C: A plugged nozzle in bit
D: Pump problems
E: Plugged choke
B: What actions need to be taken?

A: Reduce the pump rate
B: Close the well and change choke
C: All ok - continue
D: Increase the pump rate
E: Open the choke

Shut down, close the well. Start up again keeping casing pressure constant and establish new ICP.
Situation 8:

The problem was identified and the gauge in the choke panel shows the following values.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 9:

The stroke counter is zeroed and killmud is pumped into the well. After 800 strokes of kill mud the gauge shows the following values.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 10:

After pumping 2200 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke  
B: Close the choke  
C: Reduce pump rate  
D: Increase pump rate  
E: Continue – all ok
Situation 11:

After pumping 8350 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 12:

After pumping 9600 strokes, the pressure shows the following values on the choke panel. The choke is fully opened.

What actions need to be taken?

A: Close the choke
B: Open BOP and continue drilling
C: Stop pump, close in well and observe pressures
D: Reduce pump rate
02.04. Wait and weight method surface

Situation1:

Use the information and the killsheet to answer the questions in the following situations.

By using W&W method, the well should be killed with a kill rate of 35 Spm.
<table>
<thead>
<tr>
<th>FORMATION STRENGTH DATA</th>
<th>CURRENT WELL DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Lot-Off Pressure from formation strength test (A) bar</td>
<td>Current drilling fluid</td>
</tr>
<tr>
<td>Drilling fluid density at test (B) sg</td>
<td>Density 1,44 sg</td>
</tr>
</tbody>
</table>

Max. Allowable Drilling fluid density = (B) + Shoe T.V. Depth x 0.0981 = (C) sg

Casing shoe data
Initial MAASP = Size 9 5/8 in
(C) - Current density) x Shoe TVD x 0.0981 = M. Depth 2800 m
= T.V. Depth 2700 m

---

<table>
<thead>
<tr>
<th>Pump no 1 Displ</th>
<th>Pump no II Displ</th>
</tr>
</thead>
<tbody>
<tr>
<td>16,01 l/m stroke</td>
<td>16,01 l/m stroke</td>
</tr>
</tbody>
</table>

Slow pump Rate Data
25 SPM
35 SPM 28 28
45 SPM 48 48

---

<table>
<thead>
<tr>
<th>Pre-recorded Volume data</th>
<th>Length</th>
<th>Capacity</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drill Pipe x l/m = +</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Heavy Wall Drill Pipe x</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drill Collars x</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drill String Volume x (D) (E) = 2143 stks 61,2 min</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC x Open Hole x = +</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP/ HWDP x Open Hole x = +</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Hole volume x (F) = 1572 stks 45 min</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DP x Cased Hole x (G)</th>
<th>stks</th>
<th>stks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Annulus volume (F+G)+H</td>
<td>Liters 6342 stks 181,2 min</td>
<td></td>
</tr>
</tbody>
</table>

| Total Well System Volume (D+H)=(I) | Liters 8485 stks 242,4 min |
| Active Surface Volume (J) | Liters |

| Total Active Fluid System (I+J) | Liters | stks |
Surface BOP Kill Sheet- Vertical well (Metric/Bar)

### Kick Data

<table>
<thead>
<tr>
<th>SIDPP (bar)</th>
<th>SICP (bar)</th>
<th>Pit Gain (liters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>48</td>
<td>2000</td>
</tr>
</tbody>
</table>

**Kill Fluid Density**

\[
\text{KMD} = \frac{34}{3820} \times 0.0981 = 1.53 \text{ sg}
\]

**Initial Circulating Pressure**

\[
\text{ICP} = 28 + 34 = 62 \text{ bar}
\]

**Final Circulating Pressure**

\[
\text{FCP} = 1.06 \times 28 = 30 \text{ bar}
\]

\[
(K) = \frac{\text{ICP} \times \text{FCP}}{100} = 1.50 \text{ bar/100 stks}
\]

<table>
<thead>
<tr>
<th>Stroke</th>
<th>Pressure (bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>62</td>
</tr>
<tr>
<td>100</td>
<td>61</td>
</tr>
<tr>
<td>200</td>
<td>59</td>
</tr>
<tr>
<td>300</td>
<td>58</td>
</tr>
<tr>
<td>400</td>
<td>56</td>
</tr>
<tr>
<td>500</td>
<td>55</td>
</tr>
<tr>
<td>600</td>
<td>53</td>
</tr>
<tr>
<td>700</td>
<td>52</td>
</tr>
<tr>
<td>800</td>
<td>50</td>
</tr>
<tr>
<td>900</td>
<td>49</td>
</tr>
<tr>
<td>1000</td>
<td>47</td>
</tr>
<tr>
<td>1100</td>
<td>46</td>
</tr>
<tr>
<td>1200</td>
<td>44</td>
</tr>
<tr>
<td>1300</td>
<td>43</td>
</tr>
<tr>
<td>1400</td>
<td>41</td>
</tr>
<tr>
<td>1500</td>
<td>40</td>
</tr>
<tr>
<td>1600</td>
<td>38</td>
</tr>
<tr>
<td>1700</td>
<td>37</td>
</tr>
<tr>
<td>1800</td>
<td>35</td>
</tr>
<tr>
<td>1900</td>
<td>34</td>
</tr>
<tr>
<td>2000</td>
<td>32</td>
</tr>
<tr>
<td>2100</td>
<td>31</td>
</tr>
<tr>
<td>2143</td>
<td>30</td>
</tr>
</tbody>
</table>

**Diagram:**

The diagram shows a graph with the x-axis labeled as Strokes and the y-axis labeled as Pressure (bar), ranging from 25 to 65 bar. The graph appears to be a linear relation with a downward trend, indicating a decrease in pressure with increasing strokes.
Situation 2:

After pumping 20 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 3:

After pumping 210 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 4:

After pumping 300 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke  
B: Close the choke  
C: Reduce pump rate  
D: Increase pump rate  
E: Continue – all ok
Situation 5:

After pumping 1200 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 6:

After pumping 2200 strokes, the well is closed ion to check. Pressure shows the following values on the choke panel. After the check the kill operation continues.

What actions need to be taken?

A: Start-up holding Dp pressure constant

B: Start up with 30 Spm and keep the last observed circulation pressures

C: Start circulation by holding the casing pressure constant while increasing the pumps

D: The casing pressure is too high due to the killmud entering open hole. Adjust for killmud density.
Situation 7:

After pumping 4235 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation 8:

After pumping 4650 strokes, a sudden drop in the Dp pressure is observed while Csg pressure is constant.

**A: What is the problem?**

A: A washed out nozzle in bit  
B: A wash out in the drill string  
C: A plugged nozzle in bit  
D: Pump problems  
E: Plugged choke
B: What actions need to be taken?

A: Stop the pump and close the well.

B: Close the choke

C: Reduce the pump rate to reduce the casing pressure

D: Increase the pump rate

E: Open the choke
Situation 9:

The problem was identified and establishing circulation was ok. The pressure shows the following values on the gauges

What actions need to be taken?

   A: Open the choke
   B: Close the choke
   C: Reduce pump rate
   D: Increase pump rate
   E: Continue – all ok
Situation 10:

After pumping 6100 strokes, the pressure shows the following values on the choke panel.

What actions need to be taken?

A: Open the choke
B: Close the choke
C: Reduce pump rate
D: Increase pump rate
E: Continue – all ok
Situation: 11

After pumping 8600 strokes, the pressure shows the following values. The choke is open and the Csg pressure reads zero.

What actions need to be taken?

A: Close the choke
B: Open BOP and start drilling
C: Stop pump, close well and observe pressures
D: Reduce pump rate
03. Killsheet exercises

Exercise 1,2,3,4 requires that you use the given kill sheets, including formulas.

03.01. Subsea well - exercise 1

WELL DATA

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hole diameter</td>
<td>8 1/2&quot;</td>
</tr>
<tr>
<td>Well depth</td>
<td>3400 m MD 3200 m TVD</td>
</tr>
<tr>
<td>Casing weight/Depth</td>
<td>(9 5/8&quot; 53 ppf)</td>
</tr>
<tr>
<td>Distance drill floor to sea level</td>
<td>25 meter</td>
</tr>
</tbody>
</table>

EQUIPMENT, CAPACITIES AND LENGTH

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Drill pipe</td>
<td>9.14 l/m</td>
</tr>
<tr>
<td>HWDP</td>
<td>4.36 l/m 210 meter</td>
</tr>
<tr>
<td>Drill collars</td>
<td>4.01 l/m 270 meter</td>
</tr>
<tr>
<td>Choke line</td>
<td>3.2 l/m 175 meter</td>
</tr>
<tr>
<td>Riser</td>
<td>202 l/m 173 meter</td>
</tr>
<tr>
<td>Drill collar/open hole</td>
<td>15.2 l/m</td>
</tr>
<tr>
<td>Drill pipe/open hole</td>
<td>23.3 l/m</td>
</tr>
<tr>
<td>HWDP / open hole</td>
<td>23.3 l/m</td>
</tr>
<tr>
<td>Drill pipe/Casing</td>
<td>24.9 l/m</td>
</tr>
<tr>
<td>HWDP / Casing</td>
<td>24.9 l/m</td>
</tr>
<tr>
<td>Mud pump</td>
<td>19 l/stroke</td>
</tr>
</tbody>
</table>

SCR<sub>p</sub>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>35 SPM up choke line</td>
<td>38 Bar with 1.30 sg mud</td>
</tr>
<tr>
<td>35 SPM up riser</td>
<td>23 Bar with 1.30 sg mud</td>
</tr>
</tbody>
</table>

LEAK OF TEST

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mud weight</td>
<td>1.30 sg</td>
</tr>
<tr>
<td>Leak off pressure</td>
<td>120 Bar</td>
</tr>
</tbody>
</table>

MISC. DATA

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface volume</td>
<td>1860 l</td>
</tr>
<tr>
<td>5&quot; Drill pipe closed end displacement</td>
<td>13.5 l/m</td>
</tr>
<tr>
<td>Seawater density</td>
<td>1.03 sg</td>
</tr>
</tbody>
</table>

KICK DATA

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pit gain</td>
<td>3.6 m³</td>
</tr>
<tr>
<td>Mud weight</td>
<td>1.30 sg</td>
</tr>
<tr>
<td>SIDPP</td>
<td>30 Bar</td>
</tr>
<tr>
<td>SICP</td>
<td>50 Bar</td>
</tr>
</tbody>
</table>
What is the Pressure Safety Margin at the shoe when the well is first closed-in?  
Answer........................Bar

How many strokes to pump killmud from surface to bit?  
Answer........................Strokes

How many strokes to pump the kick inside casing shoe?  
Answer........................Strokes

Calculate the circulation time of killmud from surface, down the string, back up annulus to choke?  
Answer........................Minutes

Calculate how many strokes to displace the riser.  
Answer........................Strokes

Calculate KMW  
Answer........................Sg

Calculate ICP  
Answer........................Bar

Calculate FCP  
Answer........................Bar

Calculate MAASP after well is displaced to killmud?  
Answer........................Bar.

What will IDCP be after circulation is established correct?  
Answer........................Bar

What is the required mud weight to drill on, including riser margin (with killmud)?  
Answer........................Sg
03.02. Subsea well - exercise 2

**WELL DATA**
- Hole diameter: 12 1/4"
- Well depth: 3850 m MD, 3700 m TVD
- Casing ID size/Depth: (13 3/8" 54,5 ppf) 2800 m MD, 2800 m TVD
- Distance rig floor to sea level: 24 meter

**EQUIPMENT, CAPACITIES AND LENGTH**
- Drill pipe 5": 9.14 l/m
- HWDP 5": 4.36 l/m, 180 meter
- Drill collar 8": 4.01 l/m, 240 meter
- Choke line: 3.2 l/m, 200 meter
- Riser 21": 202 l/m, 195 meter
- Drill collar/Open hole: 43.6 l/m
- Drill pipe/Open hole: 62.7 l/m
- HWDP / Open hole: 62.7 l/m
- Drill pipe/Casing: 67.3 l/m
- HWDP / Casing: 67.3 l/m
- Mud pump capacity: 19.0 l/stroke

**SCR_p**
- 30 SPM up choke line: 44 Bar with 1.43 sg mud
- 30 SPM up riser: 26 Bar with 1.43 sg mud

**LEAK OF TEST**
- Mud weight: 1.38 sg
- Leak of pressure: 80 Bar

**MISC. DATA**
- 5" drill pipe closed end displacement: 13.5 l/m
- Seawater density: 1.03 sg
- Surface volume: 1860 liter

**KICK DATA**
- Pit gain: 4.45 m³
- Mud weight: 1.43 sg
- SIDPP: 35 Bar
- SICP: 46 Bar
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculate MAASP before shut in?</td>
<td>Bar.</td>
</tr>
<tr>
<td>Calculate KMW</td>
<td>Sg.</td>
</tr>
<tr>
<td>Calculate pump strokes from surface to bit?</td>
<td>Strokes</td>
</tr>
<tr>
<td>Calculate ICP</td>
<td>Bar.</td>
</tr>
<tr>
<td>Calculate FCP</td>
<td>Bar.</td>
</tr>
<tr>
<td>What will ICCP be after establishing circulation correct?</td>
<td>Bar.</td>
</tr>
<tr>
<td>Calculate how many strokes needed to circulate the kick inside the casing shoe?</td>
<td>Strokes</td>
</tr>
<tr>
<td>Calculate the total time for circulating the kick out of the well?</td>
<td>hours/minutes</td>
</tr>
<tr>
<td>Calculate strokes to displace the riser?</td>
<td>Strokes</td>
</tr>
<tr>
<td>Calculate MAASP after well is displaced to killmud?</td>
<td>Bar.</td>
</tr>
<tr>
<td>Calculate the riser margin after displacing the well to killmud?</td>
<td>Sg</td>
</tr>
</tbody>
</table>
03.03. Surface stack - exercise 3

WELL DATA
Hole diameter 8 1/2"
Well depth 3400 m MD 3200 m TVD
Casing size/Depth (9 5/8" 53 ppf) 2600 m MD 2500 m TVD

EQUIPMENT, CAPACITIES AND LENGTH
Drill pipe 9.14 l/m
HWDP 4.36 l/m 210 meter
Drill collar 4.01 l/m 270 meter
Drill collar/Open hole 15.2 l/m
Drill pipe/Open hole 23.3 l/m
HWDP / Open hole 23.3 l/m
Drill pipe/Casing 24.9 l/m
HWDP / Casing 24.9 l/m
Mud pump 19 l/stroke

SCR<sub>p</sub>
35 SPM 23 Bar with 1.30 sg mud

LEAK OF TEST
Mud weight 1.30 sg
Leak off pressure 120 Bar

MISC. DATA
5" drill pipe closed end displacement 13.5 l/m
Surface volume 1860 liter

KICK DATA
Pit gain 3.6 m<sup>3</sup>
Mud weight 1.30 sg
SIDPP 30 Bar
SICP 50 Bar
What is the Pressure Safety Margin at the shoe when the well is first closed-in? Answer.........................Bar

How many pump strokes to displace the string? Answer.........................Strokes

How many pump strokes to circulate the kick inside casing shoe? Answer.........................Strokes

Calculate the total time for circulating the killmud down the string, up annulus to choke Answer.........................Minutes

Calculate KMW Answer.........................Sg.

Calculate ICP Answer.........................Bar

Calculate FCP Answer.........................Bar

What is MAASP after displacing well to killmud? Answer.........................Bar.

What is the kick gradient? Answer.........................Bar / m.

What is the reduction on drill pipe pressure per 100 strokes while displacing the string to killmud? Answer..............Bar / 100 strokes.
03.04. Surface stack - exercise 4

WELL DATA
Well depth 3850 m MD 3700 m TVD
Casing size/Depth (13 3/8" 54,5 ppf) 2800 m MD 2800 m TVD

EQUIPMENT, CAPACITIES AND LENGTH
Drill pipe 5" 9.14 l/m
HWDP 5" 4,36 l/m 180 meter
Drill collar 8" 4.01 l/m 240 meter
Drill collar/Open hole 43,6 l/m
Drill pipe/Open hole 62,7 l/m
HWDP / Open hole 62,7 l/m
Drill pipe/Casing 67,3 l/m
HWDP / Casing 67,3 l/m
Mud pump capacity 19,0 l/stroke

SCRp
30 SPM 26 Bar with 1,43 sg mud

LEAK OF TEST
Mud weight 1,38 sg
Leak of pressure 80 Bar

MISC. DATA
5" drill pipe closed end displacement 13,5 l/m
Surface volume 1860 liter

KICK DATA
Pit gain 4,45 m³
Mud weight 1,43 sg
SIDPP 35 Bar
SICP 46 Bar
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is initial MAASP?</td>
<td>Bar.</td>
</tr>
<tr>
<td>Calculate KMW</td>
<td>Sg.</td>
</tr>
<tr>
<td>How many strokes to displace the drill string to kill mud?</td>
<td>Strokes</td>
</tr>
<tr>
<td>Calculate ICP</td>
<td>Bar</td>
</tr>
<tr>
<td>Calculate FCP</td>
<td>Bar</td>
</tr>
<tr>
<td>How many strokes to circulate the kick inside the casing shoe?</td>
<td>Strokes</td>
</tr>
<tr>
<td>Calculate total circulation time for displacing the well to kill mud</td>
<td>hours/minutes</td>
</tr>
<tr>
<td>What is the reduction on drill pipe pressure per 100 strokes while displacing the string to kill mud?</td>
<td>Bar / 100 strokes</td>
</tr>
<tr>
<td>What is MAASP after displacing the well to kill mud?</td>
<td>Bar.</td>
</tr>
</tbody>
</table>
5. Which of the following sequences describes soft shut in?

A. Open the choke and HCR’s on BOP  
Space out the string so tool joints are free of rams  
Close BOP  
Install a check valve in the string in open position  
Close the check valve  
Close the choke  
Record the pressures

B. Space out the string so tool joints are free of rams  
Close BOP  
Install a check valve in the string in open position  
Close the check valve  
Open HCR on Bop  
Record the pressures

C. Install a check valve in the string in open position  
Open HCR on Bop  
Space out the string so tool joints are free of rams  
Close BOP  
Close the choke  
Record the pressures

D. Install fully opening safety valve in the string in open position  
Close the valve  
Install a check valve and close it  
Open HCR on Bop  
Space out the string so tool joints are free of rams  
Close BOP  
Close the choke  
Record the pressures
6. Which of these sequences describes a hard shut in on a subsea, with installed heave compensator?

A Stop drilling and space out string free of rams
   Stop the pumps
   Open the choke line on Bop
   Close BOP annular
   Close the choke
   Adjust the annular closing pressure to be able to strip in
   Hang of the string on a ram
   Record pressures

B Stop drilling and space out string free of rams
   Stop the pumps
   Close BOP annular
   Close the choke
   Adjust the annular closing pressure to be able to strip in
   Hang of the string on a ram
   Record pressures

C Stop drilling and space out string free of rams
   Stop the pumps
   Close BOP annular
   Open the choke line on BOP against closed choke
   Adjust the annular closing pressure to be able to strip in
   Hang of the string on a ram
   Record pressures
7. A well is drilled from a subsea rig to 2992m TVD using 1,53sg mud. Formation pressure is 446 bar. How many stands (each 28,5m) can be pulled wet before the overbalance is lost?

- Riser capacity: 202,0 l/m
- Drill pipe capacity: 9,0 l/m
- Drill pipe steel displacement: 4,5 l/m
- Drill pipe closed end displacement: 13,5 l/m

a) 8 stands  b) 9 stands  c) 10 stands  d) 11 stands

8. A Well is drilled from a surface stack to 2670m TVD using 1,46 sg mud. Formation gradient at 2670m TVD is 0,14 bar/m. How many stands (each 28,5m) can be pulled dry before the overbalance is lost?

- Drill pipe capacity: 9,0 l/m
- Drill pipe steel displacement: 4,5 l/m
- Drill pipe closed end displacement: 13,5 l/m
- TVD casing shoe: 1880 m
- Capacity casing: 81 l/m
- Open hole casing: 76 l/m

a) 33 stands  b) 34 stands  c) 35 stands  d) 36 stands

9. After a kick is circulated and the well killed with 1,62 sg killmud, a volume of 0,9 m$^3$ dry gas is accumulated under Bop ram. Choke line is 322m and the riser filled with 1,56 mud. What will the gas volume expand to when bled off to atmosphere?

a) 45 m3  b) 46 m3  c) 47 m3  d) 48 m3

10. Plan is to strip 284m to bottom (TVD) in a vertical well with 5” DP and a BHA of 168m. BHA consists of 6 ¼” drill collar and 8 ½” Bit. There is gas in the well.

- Drill pipe capacity: 9,0 l/m
- Drill pipe steel volume: 4,5 l/m
- Drill pipe closed end displacement: 13,5 l/m
- Drill collar capacity: 4,0 l/m
- Drill collar steel volume: 15,8 l/m
- Hole capacity: 36,6 l/m

How much mud must be bled of during stripping to keep a constant bottomhole pressure?

a) 2556 liter  b) 3834 liter  c) 4487 liter  d) 5623 liter
11. What is minimum mud weight to be used for drilling into a reservoir on 795mTVD when seawater density is 1,03 sg and the formation pressure gradient is 0.12 bar/m? NB! Riser is used

a) 0.8 sg  

b) 1.10 sg  

c) 1.13 sg  

d) 1.16 sg

12. A 3486mTVD well is drilled with 1,43sg mud. The string consists of 5” Dp and 290m 6 ¼” drill collar.

- 5” Drill pipe capacity: 9,0 l/m
- 5” Drill pipe steel displacement: 4,5 l/m
- 5” Drill pipe closed end displacement: 13,5 l/m
- 6 1/4” Drill collar capacity: 4,0 l/m
- 6 1/4” Drill collar steel displacement: 15,8 l/m
- 6 1/4” Drill collar closed end displacement: 19,8 l/m
- Riser capacity: 202,0 l/m

A 3,6 m³ slug weighing 1,82 sg. is pumped

A. How will this affect BHP?

1. BHP will increase  ...............  
2. BHP will not change  ...............  
3. BHP will decrease  ...............  

B. What is the volume in the trip tank when the well is stabilized after slug is pumped and displaced to the rig floor?

a) 635 liter  
b) 982 liter  
c) 1107 liter  
d) 1156 liter
13. How much will the reduction in BHP be when 10 stands (280 meter) 5” Dp is pulled wet without filling the hole? No mud is recycled to the hole. Use the following data:

- Riser capacity: 202.70 l/m
- Drill pipe capacity: 9,50 l/m
- Drill pipe steel volume: 4,50 l/m
- Mud weight: 1.90 sg.

a) 3 bar  b) 4 bar  c) 5 bar  d) 6 bar  e) 7 bar

14. During circulating with 120 SPM and 1.43 sg mud weight in a 2160mTVD deep well, the following pressure losses are recorded:

- Pressure loss in surface equipment: 12 bar
- Pressure loss in the drill string: 51 bar
- Pressure loss in BHA: 22 bar
- Pressure loss over Bit nozzle: 138 bar
- Pressure loss in annulus: 14 bar

A. What is static BHP?
   a) 211 bar.  b) 225 bar.  c) 237 bar.  d) 303 bar.

B. What will the Standpipe pressure gauge show while circulating with 120 SPM?
   a) 211 bar.  b) 225 bar.  c) 237 bar.  d) 303 bar.

C. What is ECD while circulating with 140 SPM
   a) 1.48 sg  b) 1.50 sg  c) 1.52 sg  d) 1.54 sg

15. A well is drilled with 1.33 sg mud. The well was shut in due to kick, and the SICP was 64 Bar. Choke line is 365 m and filled with water/glycol with a density of 1.05 sg. While circulating with water/glycol and 25 SPM is CLF 8 bar is recorded. The capacity of choke line is 3.0 l/m and pump output 16 l/stroke.

A. What will IDCP be when choke line is filled with 1.33 sg mud after establishing the circulation correct with 25 SPM?
   a) 24 bar  b) 26 bar  c) 44 bar  d) 54 bar

B. How many strokes must be pumped before casing pressure reads the correct ICCP value?
   a) 67 strokes  b) 68 strokes  c) 69 strokes  d) 70 strokes
16. Following data given for a well where a kick will be circulated using wait & Weight method.:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well depth</td>
<td>3162 mMD/mTVD</td>
</tr>
<tr>
<td>Drill string volume surface to bit</td>
<td>1600 slag</td>
</tr>
<tr>
<td>Annulus volume bit to surface</td>
<td>6900 slag</td>
</tr>
<tr>
<td>SCR$_p$</td>
<td>33 bar at 30 SPM and 1,45 sg mud</td>
</tr>
<tr>
<td>SIDPP</td>
<td>38 bar</td>
</tr>
<tr>
<td>SICP</td>
<td>52 bar</td>
</tr>
<tr>
<td>Mud weight</td>
<td>1,45 sg</td>
</tr>
</tbody>
</table>

A. Calculate KMW?
   a) 1,52 sg  
   b) 1,58 sg  
   c) 1,63 sg

B. ICP after establishing circulation correct?
   a) 78 bar  
   b) 71 bar  
   c) 85 bar

C. After pumping 770 strokes the pump rate is increased from 30 SPM to 35 SPM, and at 800 strokes the drill pipe pressure is adjusted to correct value.
   What is the adjusted drill pipe pressure?
   a) 45 bar  
   b) 52 bar  
   c) 73 bar.  
   e) 64 bar

17. A Subsea rig is drilling a 26" hole below 30" conductor shoe. A 21" riser is connected to the conductor to lead the mud back to the mud pits.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance rig floor – sea level</td>
<td>25 m</td>
</tr>
<tr>
<td>Sea depth</td>
<td>135 m</td>
</tr>
<tr>
<td>Distance rig floor to 30&quot; shoe</td>
<td>230 m</td>
</tr>
<tr>
<td>Seawater density</td>
<td>1,03 sg</td>
</tr>
<tr>
<td>Formation fracture gradient</td>
<td>0,148 bar/m</td>
</tr>
</tbody>
</table>

What is maximum static mud weight at 30” shoe without fracturing formation?
   a) 1,34 sg  
   b) 1,16 sg  
   c) 1,06 sg  
   d) 1,03 sg

During drilling of the 26" hole the annulus pressure loss is 0,6 Bar. What is maximum mud weight during drilling/circulating?
   a) 1,31 sg  
   b) 1,13 sg  
   c) 1,03 sg  
   d) 1,01 sg
18. A kick is circulated out using Drillers method. Circulation rate is 20 SPM and FCP 44 bar. Circulation rate is increased to 30 SPM. What will the new FCP be?

   a) 75 bar.   b) 94 bar.   c) 99 bar.   d) 103 bar.

19. A 3650mTVD deep well is stabilized with 1,53 sg killmud, the killmud give 11 bar overbalance on pore pressure at 3650mTVD. Riser capacity 202 l/m and have a length of 274m. Seawater density is 1,03 sg and the distance from rig floor to sea level is 24 meters. What is minimum mud weight for drilling on, included riser margin?

   a) 1,50 sg.   b) 1,53 sg.   c) 1,55 sg.   d)1,58 sg.

20. While tripping the drill string out the well is filled correctly during pulling dry drill pipe. The Drill collars is also pulled dry but without filling the well. What is reduction in BHP when all the Drill collars are pulled?

   Well data
   Drill collar length 135 meter
   Drill collar steel volume 36,5 l/m
   Drill collar capacity 4,5 l/m
   Riser capacity 76 l/m
   Annulus capacity Drill collar/12 ¼” open hole 35 l/m
   Mud weight 1,41 sg

   a) 8 bar   b) 10 bar   c) 7 bar   d) 9 bar

21. During drilling an increase in connection gas. What will be correct action? (Choose two answers).

   a) Only have one connection gas in the well
   b) Pump a low viscose pill to clean balled bit
   c) Reduce the connection time as much as possible.
   d) Increase the muds yield point
   e) Pull out of hole and change bit
22. During a kill operation a gas bubble is circulated into the casing shoe as indicated on the figure. How will the pressure at the shoe vary as the gas is circulated into the casing?

   a) Pressure increases  
   b) Pressure decreases  
   c) Pressure will not change

23. When a gas bubble is circulated into the casing during a kill operation, how will the pressure at shoe vary as the gas is circulated towards surface?

   a) Pressure increases  
   b) Pressure decreases  
   c) Pressure will not change

24. What will be your action in a kill operation, when the gas is circulated up to the Bop and the gas/mud mix is displacing choke line as shown on the figure?

   a) Reduce choke opening  
   b) Reduce pump rate  
   c) Increase the choke opening  
   d) Avoid adjusting the choke.
25. In which situation recording new SCRp?
   (Choose two answers).
   a) Before drilling out the casing shoe.
   b) Start of each tour (shift)
   c) Immediately after drilling out the casing shoe.
   d) Every time mud density is changed.
   e) Immediately before running casing

26. Which statements are correct regarding recording SCRp?
   (Choose three answers).
   a) The pressure should be recorded while circulating through fully open choke
   b) The pressure should be read on the gauge installed on the choke panel.
   c) The pressure should be recorded with bit at bottom.
   d) The pressure is necessary to estimate the formation pressure.
   e) The pressure should be recorded when the mud properties are changed

27. In a well using a 1.40 sg mud weight a formation water kick is taken. The kick height is 55m and the formation water has a density of 1.03 sg.

What is SICP?
   a) 23 bar
   b) 24 bar
   c) 25 bar
28. A Well will be killed using the Drillers method, SIDPP is 35 bar and SICP is 62 bar. After the kick is circulated out the well is closed in and the pressures stabilized, SIDPP and SICP shows 35 bar and 45 bar. It is decided to not spend any more time cleaning the well. Which of the following procedures must be used?

a) Continue the second phase of Drillers method, holding constant Csg pressure while killmud is circulated to the bit.

b) Bullhead annulus until SICP is reduced to 35 bar.

c) Continue the second circulation of Drillers method by following a calculated graph for drill pipe pressure while killmud is circulated to the bit.

d) Circulate down annulus and up the drill string (Reverse Circulate) until the casing pressure is reduced to 35 bar.

29. How would you define MAASP?

a) The total pressure that could fracture the shoe

b) The extra pressure that can be added to the static mud pressure on the shoe, before the shoe fractures or the casing bursts.

c) The maximum extra pressure on the drill pipe gauge during well kill.

d) Maximum allowed BHP during well kill

30. Which of the following statements is good operating practice during drilling of top hole, where there is possibility of shallow gas? (Choose two answers).

a) Use high mud density to create maximum over balance.

b) Restrict the penetration rate

c) Pump viscous fresh water pills to clean the well of cuttings.

d) Keep pumps running while pulling out of the well.

e) Keep a high penetration rate
01. Valves installed in the drill string

Question 1:

The illustration shows an inside BOP. Some of the components are marked with numbers. Indicate with numbers from the illustration where the following components are located.

1.阀
2.上体
3.座
4.下体
5.释放工具体
6.释放杆

___ Valve
___ Upper body
___ Seat
___ Lower body
___ Release tool body
___ Release rod
Question 2:
While tripping the well, it becomes unbalanced. The well is then closed. It is decided to strip back to the bottom. There is no drill pipe float. What equipment should be mounted on the top of the drill pipe to be able to strip safely back to the bottom?

a. An inside BOP and a Kelly cock in closed position above it.
b. Only a Kelly cock in closed position.
c. Only an inside BOP.
d. A Kelly cock in open position and an inside BOP above it.
e. Only a Kelly cock in open position.

Question 3:
A Kelly cock or a Full Opening Safety Valve (FOSV) should always be present on the drill floor fitted to the pipe dimensions used. Which three statements are correct for a Kelly cock?

a. Must not be run in the well in close position.
b. Must be pumped in open position to enable reading SIDPP.
c. Very often leaks through valve crank sleeve.
d. It is not possible to run wire line through the valve.
e. Must have the right key to be operated.
f. Is kept in open position by a bolt screwed in with a T-handle.

Question 4:
An inside BOP should always be present on the drill floor fitted to the pipe dimension used. Which three statements are correct for an inside BOP?

a. Must be pumped in open position to enable reading SIDPP.
b. Very often leaks through valve crank sleeve.
c. Must not be run in the well in closed position.
d. Is kept in open position by a bolt screwed in with a T-handle.
e. It is not possible to run wire line through the valve.
f. Must have the right key to be operated.

Question 5:
What pressure should drill pipe mounted valves be tested at?

a. Always a test pressure of 690 Bar
b. Twice the working pressure.
c. Maximum expected surface pressure, but not higher than the working pressure of the BOP.
d. One and a half times the working pressure.
Question 6:
Answer D for Disadvantage and A for Advantage if there is float in the drill pipe.

- a. Circulation down the annular and up the drill pipe is not possible.
- b. Reading of shut in drill pipe pressure (SIDPP).
- c. The valve prevents formation fluids from entering the drill pipe.
- d. Greater strain on the formation when the drill pipe is run in.
- e. The drill pipe must be filled when run in.

Question 7:
The illustration shows a Kelly cock. Some of the components are marked with numbers. Indicate with numbers from the illustration where the following components are located.

---

1. Ball
2. Lower seat
3. Upper seat
4. Body
5. Crank
02. Blowout preventers

Use the figure below to answer questions 1-4

![Blowout Preventer Diagram]

**Question 1:**
Shear ram is closed due to a kick. Can the well be killed by Driller's Method?

a. Yes
b. No

**Question 2:**
Lower pipe ram is closed due to a kick. Can the well be killed by Driller's Method?

a. Yes
b. No

**Question 3:**
Upper pipe ram is closed due to a kick. Can the well be killed by the Wait & Weight Method?

a. Yes
b. No

**Question 4:**
Shear ram is closed due to a kick. Can the well be killed by the Wait & Weight Method?

a. Yes
b. No
Use the figure below to answer questions 5 - 9.

**Question 5:**
Lower pipe ram is closed due to a kick. Can the well be killed by the Wait & Weight Method?

a. Yes
b. No

**Question 6:**
There is drill pipe in the well. Is it possible to close the well by pressure and maintain/repair the outlets for choke or kill line?

a. Yes
b. No

**Question 7:**
There is no drill pipe in the well. Is it possible to close the well by pressure and maintain/repair the outlets for choke or kill line?

a. Yes
b. No
**Question 8:**
The drill pipe is in the well. Is it possible to close the well and circulate through the drill pipe?

- a. Yes
- b. No

**Question 9:**
The drill pipe is in the well. While work is going on to convert the blind/shear ram to pipe ram, the well becomes unbalanced. Is it possible to close the well?

- a. Yes
- b. No

**Question 10:**
The specification of a BOP is: 10K, 18 3/4" - RSRdA. What does the specification 18 3/4" mean?

- a. The diameter of the drill pipe valves operating cylinders.
- b. The bore of the annular and pipe rams.
- c. The outer diameter of the flanges.
- d. The outer diameter of the body.

**Question 11:**
What working pressure is required of a BOP?

- a. Maximum expected MAASP.
- b. Maximum expected bottomhole pressure.
- c. Maximum expected static pressure on the choke manifold.
- d. Maximum expected mud pressure.
- e. Maximum expected pore pressure.
- f. Maximum expected surface pressure.

**Question 12:**
What should be done first, after having connected the hydraulic lines for open and close functions on a BOP?

- a. Perform an operating test on the BOP.
- b. Test the accumulator pumps.
- c. Set annular and rams in block position and start drilling.
- d. Check usable fluid volume in the accumulator bottles.
Question 13:
When should a complete pressure test be made on a BOP, according to API RP 53? Choose two answers.

a. Minimum every second month.
b. After having set casing.
c. After a change of the components on the BOP.
d. After having killed a kick.

Question 14:

A: Before a BOP with a working pressure of 690 bar / 10 000 Psi is delivered from the factory, it should be pressure tested (Body shell test). What percentage of the working pressure should be used during the test?

a. 100 % of the working pressure.
b. 125 % of the working pressure.
c. 150 % of the working pressure.
d. 200 % of the working pressure.

B: The figure shows lower marin riser package (LMRP). Number the components

___Riser connector
___Control pod
___Accumulator bottles
___Flex joint
___Flexible hoses
Use the figure to answer questions 15 – 18
**Question 15:**
There is pipe in the hole. Shear/blind is closed due to a kick. Can the well be killed using drillers method?

a. Yes  
b. No

**Question 16:**
There is pipe in the hole. Upper annular is closed due to a kick. Can the well be killed using drillers method?

a. Yes  
b. No

**Question 17:**
There is pipe in the hole. Lower annular is closed due to a kick. Can the well be killed using Wait and weight method?

a. Yes  
b. No

**Question 18:**
There is pipe in the hole. Lower pipe ram is closed due to a kick. Can the well be killed using Wait and weight method?

a. Yes  
b. No

**Question 19:**
To test a 690 Bar (10000 Psi) Bop a cup tester (in 9 5/8” casing) run on 5” Drill pipe in will be used. The cup tester has an area of 274 cm2 (42,4 inch2). What’s the lowest grade drill pipe that can be used (Do not include any safety margin)

a. Any quality drill pipe, as long as it can withstand the test pressure.  
b. Grade S–135 premium drill pipe, tensile strength: 560100 lbs./249.100 daN)  
c. Grade E–75 premium drill pipe, tensile strength: 311200 lbs./138.400 daN  
d. Grade G–105 premium drill pipe, tensile strength: 436150 lbs./194.000 daN
Question 20:

BOP specification:
Cameron U II type BOP
Working pressure: 1034 bar/15000 psi
Nominal size: 18 ¾” inch
Closing ratio: 9,3 : 1
Opening ratio : 3,5 : 1

The well is closed using middle pipe ram.
After shut in a pressure of 264 bar/3828 psi is recorded below middle pipe ram..

It is decided that a tool joint will be stripped through middle pipe ram.

What will be next step in this operation?

- a. Close upper pipe ram, then pressure up to 264 bar/3828 psi pressure between upper pipe ram and middle pipe ram. And then open middle pipe ram.
- b. Close upper pipe ram, then open middle pipe ram.
03. Annulars and rams

Question 1:
The illustration shows a Hydril GL annular.

Which 2 statements are correct?

a. Lowest closing pressure is achieved by connecting the closing chamber and the secondary chamber.
b. The opening forces that affect the ram from the mud pressure in the riser can be balanced by using the secondary chamber.
c. Lowest closing pressure is achieved by connecting the opening chamber and the secondary chamber.
Question 2:
The illustration shows a Hydril GL annular. Write the correct number.

___ Opening chamber
___ Primary closing chamber
___ Secondary Closing Chamber/Balance Chamber
___ Packer element
___ Piston
___ Opening Chamber Head
Question 3:
Which ram can be used to hang off the drill pipe?

a. The annular ram  
b. Blind/shear ram  
c. Pipe rams  
d. The diverter

Question 4:
The illustration shows a Hydril GK annular. Write down the correct number for the components.

___ Opening chamber  
___ Closing chamber  
___ Packing unit  
___ Piston  
___ Screwed head
Question 5:
The illustration shows a Cameron/Cooper U type pipe ram.

Write down the correct number for the components.

- Top seal
- Ram block.
- Front packer.

Question 6:
What must be checked before installation of a packer unit in an annular? (Choose 2 of the answers).

a. Desired hydraulic operating pressure.
b. The temperature limit of the packer unit.
c. The type of mud to be used in the well.
d. Outer diameter of the drill pipes.
Question 7:
The most common fixed front packers used in pipe rams are placed between two steel plates. Why are they made in this way? Choose two of the answers.

a. To prevent damage on the rubber between the drill pipe and the ram block when the pipe rams are in a closed position and the well is under pressure.
b. To enable the pipe rams to hold the weight of the drill pipe when the drill pipe is hung off.
c. To push forth the rubber when the seal face is worn.
d. To prevent swelling of the rubber at high temperatures.

Question 8:
Is it true that all pipe rams can close against full well pressure when the operating pressure is 103 bar/1500 Psi.

a. No
b. Yes

Question 9:
Which statement is correct for pipe rams. (Choose three of the answers).

a. A pipe ram can be used to hang off the drill pipe.
b. The pipe ram is made such that it only holds full working pressure from the top side when the ram is closed.
c. When the pipe ram is closed, the well pressure will help keeping it closed.
d. The pipe ram is made such that it only holds full working pressure from below when the ram is closed.
e. The pipe ram is made such that it holds full working pressure from the top side and below when the ram is closed.
Question 10:
The illustration shows a Cameron/Cooper pipe ram. Indicate the components by numbers.

_____ Intermediate flange
_____ Housing Locking Screw
_____ Bonnet Seal
_____ Ram Change Cylinder
_____ Ram Change Piston, open
_____ Bolt, Bonnet
Question 11:
The illustration shows a Shaffer shear ram. Indicate the components by numbers.

___ Lower blade
___ Lower ram block
___ Upper ram block
___ Lower Rubber
___ Upper ram block holder
Question 12:
The illustration shows a Cameron/Cooper pipe ram. Indicate the components by numbers.

_____ Ram Assembly
_____ Operating Cylinder
_____ Operating Piston
_____ Locking Screw
_____ Bonnet
_____ Body
**Question 13:**
During pressure test of a pipe ram fluid leaks from the weep hole. What must be done?

a. Screw in secondary emergency packing: If the leakage stops, the pipe ram is repaired at next planned maintenance.
b. The weep hole controls only the opening chamber of the pipe ram. That is why it can be repaired at next planned maintenance.
c. The primary packing of the ram shaft seal leaks. Secure the well and change the primary packing immediately.
d. The packer element of the ram block system is worn. Secure the well and change the packer element immediately.

**Question 14:**
How is the term *closing ratio* defined for pipe rams?

a. The relation between opening time and closing time of the pipe ram.
b. The relation between closing volume and opening volume of the pipe ram.
c. The relation between the pressures required to close the pipe ram and the pressure at the well head.
d. The relation between the maximum and minimum pressure of the accumulator.

**Question 15:**
The illustration shows the pipe ram of a Shaffer "multi-ram".

Mark the numbers of the following components.

![Diagram]

1. Seal Top
2. Seal Face
3. Block
4. Holder Ram
5. Screw Retracting
Question 16:
The illustration shows a Cooper shear ram.

Indicate the components by numbers.

_____ Side packers
_____ Ram face packer
_____ Top seal
_____ Upper ram block
_____ Lower ram block
Question 17:
The illustration shows a Cameron/Cooper annular. Indicate the components by numbers.

- [ ] Opening hydraulic port
- [ ] Pusher plate
- [ ] Closing hydraulic port
- [ ] Vent
- [ ] Operating piston
Question 18:
The illustration shows a Cameron/Cooper annular. Indicate the components by numbers.

1. Packer Insert
2. Donut
3. Opening side of Piston
4. Packer
5. closing side of Piston
04. Choke manifolds.

Question 1:
What is the main purpose of a choke/kill manifold?

a. To close in the well
b. To be able to read the closing pressure
c. To regulate pressure and circulate/kill a kick
d. To test the BOP and connections.

Question 2:
Based on the illustration from a surface installation, the well is closed in by the annular because of a kick. Which valves must be in open position to kill the well and control the well when the kick is to be circulated out by the mud pump, down the drill pipe, through remote controlled choke and to mud/gas separator?

Note! Write the numbers in a rising sequence.

Question 3:
Based on the following diagram for a surface installation; lower pipe ram is closed. It is to be circulated down the kill line, out the choke line, through the manual choke and back to the mud tanks by the cement pump. The pressure must be read. Which valves must be open?

Note! Write the numbers in a rising sequence.

05. Control system for a surface BOP.

**Question 1:**
What is the response time for an 18 ¾” pipe ram?

- a. 15 Seconds
- b. 30 Seconds
- c. 45 Seconds

**Question 2:**
What is the response time for an 18 ¾” annular?

- a. 30 Seconds
- b. 45 Seconds
- c. 60 Seconds

**Question 3:**
What is the response time for a 21 ¾” annular?

- a. 60 Seconds
- b. 30 Seconds
- c. 45 Seconds

**Question 4:**
What is the response time for a 21 ¾” pipe ram?

- a. 30 Seconds
- b. 45 Seconds
- c. 60 Seconds

**Question 5:**
What is the response time for a 13 5/8” pipe ram?

- a. 15 Seconds
- b. 45 Seconds
- c. 30 Seconds

**Question 6:**
What is the response time for a 13 5/8” annular?

- a. 30 Seconds
- b. 15 Seconds
- c. 45 Seconds
Use the figure below to answer question 7 - 9.
Question 7:
The picture shows a hydraulic accumulator and control unit. Put in correct number for the following components:

___ Accumulators
___ Check valve
___ Electric motor driven triplex or duplex pump assembly
___ 4-way valves
___ Accumulator shut-off valve

Question 8:
The picture shows a hydraulic accumulator and control unit. Put in correct number for the following components:

___ Manifold reducing and regulating valve.
___ Accumulator pressure gauge
___ Air operated hydraulic pumps.
___ Pneumatic pressure transmitter
___ Suction strainer
___ Panel-unit selector

Question 9:
The picture shows a hydraulic accumulator and control unit. Put in correct number for the following components:

___ Manifold pressure gauge
___ Accumulator relief valve
___ Annular pressure reducing and regulating valve – air operated
___ Automatic hydro-electric pressure switch
___ Annular preventer pressure gauge
___ Automatic hydro-pneumatic pressure switch
**Question 10:**
Annular is closing. On which two gauges on the remote control panel will you be able to observe a variation in pressure? Choose 2 of the answers.

- a. Air pressure.
- b. Accumulator pressure.
- c. Annular pilot-/read back pressure*.
- d. Manifold pilot-/read back pressure*.

**Question 11:**
A pipe ram is closing. On which two gauges on the remote control panel will you be able to observe a variation in pressure?

*Choose 2 of the answers.*

- a. Manifold pilot-/read back pressure*.
- b. Accumulator pressure.
- c. Air pressure.
- d. Annular pilot-/read back pressure*.

**Question 12:**
The gauge for air pressure on the remote control panel indicates zero.

From the following statements choose the correct one.

- a. Only the annular can be operated from the panel.
- b. Shear ram can still be operated from the panel.
- c. All of the BOP safety valve functions can still be operated from the panel.
- d. None of the above mentioned functions can be operated from the panel.
**Question 13:**
The starting point is that the gauges on the panel are correct set, when the drilling operation starts. After a while the following changes appear on the panel (observe enclosed drawing).

Which of the following statements indicate the most common error?

a. Leakage in accumulator manifold.
b. Instrument error or error in the pressure transmitter.
c. Leakage in the manifold regulator.
d. Leakage in the regulator which regulates annular operation pressure.
Question 14:
The starting point is that the manometers on the panel are correct set, when the drilling operation starts. After a while the following changes appear on the panel. (Observe enclosed drawing)

Which of the following statements indicate the most common error?

Choose two of the answers.

a. Leakage in the regulator, which regulates annular operation pressure
b. Leakage in accumulator manifold.
c. Leakage in manifold regulator.
d. Instrument error / error in pressure transmitter.
e. Leakage in the bypass valve.
Question 15:
The starting point is that the manometers on the panel are correct set, when the drilling operation starts. After a while the following changes appear on the panel. (Observe enclosed drawing)

Which of the following statements indicate the most common error?

- a. Leakage in the regulator, which regulates annular operation pressure.
- b. Leakage in accumulator manifold.
- c. Leakage in manifold regulator.
- d. Faulty annular regulator

Question 16:
What is the normal accumulator pressure in the BOP control system?

- a. 103 bar/1500 psi
- b. 140 bar/2000 psi
- c. 69 bar/1000 psi
- d. 207 bar/3000 psi

Question 17:
What is the normal manifold pressure in BOP valve control system?

- a. 103 bar/1500 psi
- b. 207 bar/3000 psi
- c. 69 bar/1000 psi
- d. 140 bar/2000 psi
**Question 18:**
Within what operational range shall the operational pressure of the annular be set?

a. 41 – 103 bar/600 - 1500 Psi  
b. 20 – 69 bar/290 - 1000 Psi  
c. 103 – 207 bar/1500 - 3000 Psi

**Question 19:**
On the remote control panel on drill floor you always have to push and hold the button called, "Master control valve", for 6 Seconds before you will be able to operate the function you want to activate.

a. True.  
b. Not true.

**Question 20:**
On the remote control panel on drill floor you always have to push the button called "master control valve", together with the function you want to operate.

a. True.  
b. Not True.

**Question 21:**
On the remote control panel on drill floor "master control valve" will let pressure and power to all functions you want to operate from this panel.

a. True.  
b. Not True.

**Question 22:**
If you activate a function on the remote control panel without activating "master control valve", this function will not be carried out.

a. True.  
b. Not True.
Question 23:
On the Hydraulic unit on a surface BOP there is a "Panel - Unit selector valve". It is set in position UNIT.

Choose two correct statements.

a. The regulator which regulates operation pressure to annular cannot be operated from the panel on drill floor.
b. The electrical driven pumps are disconnected.
c. All functions on BOP can be closed or opened.
d. None of the functions on BOP can be closed or opened.

Question 24:
Electrical button for “close annular” is operated. Indicator light changes from green to red, but the gauges are constant. Identify the most frequent reason for this condition.

a. 4/3 valve did not change position.
b. There are errors on the indicator lights.
c. Hydraulic leakage in the lines to the BOP.
d. There is a blockage in the lines to the BOP.

Question 25:
Electrical button for “close upper pipe ram” is operated. Indicator light changes from green to red, the gauge that reads back pressure is dropping, but is not rising again and the flow meter does not stop counting. Identify the most frequent reason for this condition.

a. 4/3 valve did not change position.
b. There are errors on the indicator lights.
c. Hydraulic leakage in the lines to the BOP.
d. There is a blockage in the lines to the BOP.

Question 26:
Electrical button for “close upper pipe ram” is operated. Indicator light does not indicate red, the gauge that reads back pressure, drops and then rises again to the preset pressure. Identify the most frequent reason for this condition.

a. Hydraulic leakage in the lines to the BOP.
b. There is a blockage in the lines to the BOP.
c. There are errors on the indicator lights.
d. 4/3 valve did not change position.
Question 27:
On drillers panel there is a bypass valve, what is the usage of this valve?
   a. To bypass Drillers control panel in order to use Drilling Supervisors remote control panel.
   b. To bypass the regulated manifold pressure and use accumulator pressure.
   c. To bypass all of the BOP valves functions and operate blind/shear ram.

Question 28:
Control system for BOP will be equipped with charging pumps; these pumps are set to operate after specific procedures. API RP53 describes one of the demands as follow: “When accumulators are disconnected, the charging pumps will do the following operations: Close annular, open a hydraulic valve on choke-/kill line and keep a pressure of 200 psi over precharge pressure within?
   a. 1 Minute or less.
   b. 2 Minutes or less.
   c. 3 Minutes or less.
   d. 4 Minutes or less.

Question 29:
On the hydraulic accumulator – and control unit for BOP there are several 4/3 valves (manipulator valves) to operate the functions on the BOP. Which statement is correct regarding 4/3 valves?
   a. 4/3 valves center position has closed the entry on the pressure side and outlet side.
   b. 4/3 valves is an electric guided valve which operates the pilot signals.
   c. 4/3 valves center position has closed the entry on the pressure side and outlet side are vented to the tank.
   d. 4/3 valves center position has open entry on pressure side and outlet is open.

Question 30:
On the hydraulic accumulator – and control unit for BOP there are several 4/3 valves (manipulator valves) to operate the functions on the BOP valve. Which statement is correct regarding 4/3 valves? Choose three alternatives.
   a. 4/3 valve have three connections.
   b. 4/3 valve cannot be remote controlled.
   c. 4/3 valve have four connections.
   d. 4/3 valve can be set in three positions.
   e. 4/3 valve can be set in four positions.
   f. 4/3 valve can be manually operated.
Question 31:
Based on the following diagram for a surface hydraulic accumulator -/ and control unit.

Which valves must be close when ready for drilling?

Note! Write the numbers in a rising sequence.

No.: ____ - ____ - ____ - ____ - ____
06. Accumulators.

**Question 1:**
What is the API RP 53 definition of usable fluid volume?

a. The total fluid volume that can be taken out of the bottles between the working pressure of the accumulator and 55 bar/800 Psi above the precharge pressure.

b. The total fluid volume that can be stored in the tank.

c. The volume that can be taken out of the bottles between max. pressure 207 bar / 3000 Psi and 14 bar/200 Psi above the precharge pressure.

d. The total volume that can be stored in the accumulator bottles.

e. The volume that can be taken out between maximum working pressure and the precharge pressure.

**Question 2:**
All the functions of the BOP must be closed + opened + closed. What fluid volume must be stored in the accumulator bottles?

Use the values below for the calculation:

1 annular: Close 120 l. - open 112 l.
2 Pipe Rams: Close 48 l. - open 44 l.
The hydraulically controlled valves on the choke/kill line: Close 1.2 l. - open 0.8 l.

a. 490 l.
b. 638.4 l.
c. 512 l.
d. 600 l.

**Question 3:**
Which gas is used to precharge the accumulator bottles?

a. Oxygen
b. Ordinary air
c. Nitrogen
d. Carbon dioxide
Question 4:
An hydraulic accumulator and control unit of a BOP has 12 accumulator bottles. Each bottle has a capacity of 15 gallon. The precharge pressure is 69 bar / 1000Psi. Maximum pressure is 207 bar / 3000 Psi. What is the total usable fluid volume of the accumulator manifold, when the min. pressure of the bottles is 83 bar / 1200 Psi?

a. 85 gallons
b. 90 gallons
c. 93 gallons
d. 108 gallons

Question 5:
What are the two main reasons for storing pressurized fluid on the accumulator bottles of the hydraulic unit of the BOP? Choose two answers.

a. To replace the mud during the weekly test of the BOP.
b. To be able to operate the choke/kill line from the BOP.
c. To be able to operate the remotely controlled choke.
d. To be able to close the rams of the BOP if the energy supply disappears.
e. To reduce the closing time of the BOP.

07. Diverter systems.

Question 1:
Which of the components are equipment for a 29 1/2" diverting system?

Choose two of the answers.

a. A pipe ram of small diameter.
b. A low pressure annular with a large bore.
c. A vent line of large diameter.
d. A vent line of small diameter.
e. A low pressure annular with a small bore.
Question 2:
The illustration shows parts of a diverting system.

Indicate the correct terms for the components.

___ Flow line seals
___ Insert packer
___ Closing port
___ Packer element locking bolt
___ Outer Packer
Question 3:
The illustration shows a diverting system set for drilling. The wind is blowing from port to starboard, i.e. from left to right on the illustration.

Which operational sequence is correct if the diverting system is to be activated at a blow out?

a. Open D, close B, and close F  
b. Close F, open C, and close B  
c. Open C, close B, and close F  
d. Close F, open D, and close B
08. Mud gas separator (Poor boy)

Question 1:
Look at the illustration below. Data for the separator:

- Mud weight: 1.27 sg
- Dip tube height: 3.2 m

Which pressure can be read on the gauge when there is flow through the separator?

__________ Bar
Question 2:
The illustration shows a mud/gas separator.

Which dimensions would under ordinary operational conditions determine the pressure build-up in the separator?

a. The height of the dip tube H1.
b. Vent line H3 and the bore of vent line D3.
c. The line from the choke manifold with the length L1 and the bore D1.
d. The height H2.
09. Mechanical couplings

Question 1:
The illustration shows an API 6B flange. Different dimensions are indicated with numbers.

Answer with a number where the nominal dimension of the flange is given.

No: _____
Question 2:
The illustration 1, 2 and 3 show three different types of flanges for connection to the BOP.

Which of the illustrations shows a studded connection?

No: _____
Question 3:
The illustrations show the profiles of API 6B and 6BX flanges. One of the flanges has a certain distance between the flanges after connection and will therefore need periodic retightening of bolts and nuts.

Which of the flanges is that?

a. 6BX  
b. 6B

Question 4:
Which of the following ring gaskets will not fit an API type 6B flange?

a. Type BX  
b. Type RX  
c. Type R Oval  
d. Type R Octagonal

Question 5:
Which of the following ring gaskets are of the type pressure energized? Choose two of the answers.

a. Type R Oval  
b. Type RX  
c. Type BX  
d. Type R Octagonal
01. Principles and procedures – various exercises

Question no. 1.
   a. A washout in the drill string.
   b. A washout in a pressure valve (float) in the drill string.

Question no. 2.
   d. 1.03 sg.

Question no. 3.
   a. Wait and Weight method.

Question no. 4.
   c. Install an inside BOP.

Question no. 5.
   a. When pulling first few stands off bottom.

Question no. 6.
   b. The mud viscosity is high.
   c. Pulling the drill string through tight spots without pumping.
   d. Pulling on the drill string fast.

Question no. 7.
   b. 40 bar

Question no. 8.
   a. True.

Question no. 9.
   b. When the top of the influx reaches the choke.

Question no. 10.
   b. It may result in a further influx occurring.

Question no. 11.
   b. The casing shoe will be subjected to an unnecessary additional 10 bar for the duration of the kill operation.

Question no. 12.
   b. It increases.

Question no. 13.
   c. Pump operator brings pump up slowly whilst informing the choke operator at regular intervals about the increase in pump rate - choke operator maintains last observed reading on the casing pressure gauge.

Question no. 14.
   c. Some mud is lost to the formation.

Question no. 15.
   b. Soft shut in procedure.

Question no. 16.
   All answers could be correct

Question no. 17.
   e. It gives an indication of formation permeability.

Question no. 18.
   c. The influx has flown into the drill string.
Question no. 19.  
   b. To avoid to exceed the operational limitation of the well control syst.
   d. To minimize the pressure on the well bore.

Question no. 20.  
   a. No.

Question no. 21.  
   c. Increase.

Question no. 22.  
   c. The vertical depth.

Question no. 23.  
   c. When formation pressure is greater than mud hydrostatic pressure.

Question no. 24.  
   a. Increasing flow rate.
   c. Increase in the mud pits
   d. A positive flow check.

Question no. 25.  
   Has a kick occurred? No.
   How many warning signs are noted? 4.
   Would you notify tool pusher? Yes.

Question no. 26.  
   c. Run back to bottom, circulate and condition mud

Question no. 27.  
   b. Restore safe primary control. Run back to bottom and circulate bottom’s up

Question no. 28.  
   1. a. increasing mud temperature
   2. a. increasing mud conductivity
   3. a. Increasing drill rate
   4. a. Increase in connection gas.

Question no. 29.  
   d. Running in too fast
   f. Tight hole.

Question no. 30.  
   b. When the first few stands are pulled off bottom.

Question no. 31.  
   b. False

Question no. 32.  
   b. Circulating out a kick with constant bottomhole pressure.

Question no. 33.  
   c. 0.101 bar/ m.

Question no. 34.  
   e. Annulus pressure losses.

Question no. 35.  
   d. Using the pump pressure/mud weight relationship to the slow circulation rate pressure (SCRp).

Question no. 36.  
   c. Reduce pump rate and add lost circulation materials.

Question no. 37.  
   c. 0.07 sg.

Question no. 38.  
   b. When the top of the influx reached the casing shoe.
Question no. 39. e. The Wait and Weight method will give a lower casing shoe pressure than the Drillers method if the open hole annulus volume is greater than the drill pipe volume.

Question no. 40. c. Close in well and establish SIDPP and SICP. Allow SIDPP to increase 3 to 7 bar. Bleed off through choke to maintaining the SIDPP until first gas gets to surface or rig power is available.

Question no. 41. b. It is too low.

Question no. 42. c. Stop pumping and close BOP choke line valve(s).

Question no. 43. b. 0 bar.

Question no. 44. c. Because the influx is usually is less dense than the mud.

Question no. 45. b. The drill pipe pressure gauge is accurate.
   e. The correct mud weight is known.
   f. The bit is on or near bottom and the drill string is full of mud.

Question no. 46. b. SCRs should be taken after BHA is changed.
   c. SCRs should be taken after mud weight changed.
   e. SCRs should be taken if there is any appreciable change in depth of the hole.

Question no. 47. c. Decreases.

Question no. 48. c. Decreases by 16 bar.

Question no. 49. d. SIDPP is maintained at 27 bar.

Question no. 50. b. Weight acting on an unit area.

Question no. 51. c. Formation porosity.

Question no. 52. d. Formation cuttings in the mud.

Question no. 53. c. Gas increase is due to loss of bottomhole pressure during flow check.
   e. Gas is liberated from drilled formation.

Question no. 54. b. High permeability.

Question no. 55. b. Can be prevented if warnings signs are noted.

Question no. 56. c. Possible swabbing during a trip.

Question no. 57. a. Bottomhole pressure is greater.

Question no. 58. c. An increase in shale density.
Question no. 59. c. Decrease in rate of penetration (ROP)

Question no. 60. a. Above.

Question no. 61. d. A 690 bar BOP.

Question no. 62. d. The choke is blocked.

Question no. 63. c. Not enough information to calculate

Question no. 64. d. An increase in drilled depth.
   e. A "loaded" annulus.

Question no. 65. e. At initial shut in.

Question no. 66. c. Operate the choke to reduce the casing pressure to 55 bar.

Question no. 67. b. The choke is plugging.

Question no. 68. d. A bit nozzle has plugged.

Question no. 69. b. The choke is plugging.

Question no. 70. a. The choke is washing out.

Question no. 71. c. A bit nozzle has washed out.

Question no. 72. c. Washout in the drill string.
   f. Unplugging of a bit nozzle.

Question no. 73. c. Stop pump no. 1, Close the choke and close the Kelly cock.

Question no. 74. b. Run back to bottom and circulate bottoms up.

Question no. 75. b. Pump slowly down the drill pipe until the casing pressure
gauge flicks. Etc. etc.
   d. Pump down the drill string until SICP increases with some psi.
      Read the stabilized shut in drill pipe pressure etc. etc.

Question no. 76. c. True.

Question no. 77. a. When pulling the first few stands of bottom.

Question no. 78. c. Mud hydrostatic is less than formation pressure.
   e. High formation permeability.

Question no. 79. a. Increase in flow rate out
   b. Pit gain
Question no. 80.  b.  The influx is higher.
            e.  The danger of breaking down the shoe.

Question no. 81.  b.  An decrease in porosity.
            d.  An increase in the overbalance.

Question no. 82.  d.  Pull up, check for flow, if negative, circulate and inform the tool pusher or the company man.

Question no. 83.  c.  Not keeping hole full.

Question no. 84.  b.  Any time the well is open.

Question no. 85.  b.  An accurate pressure gauge.
            c.  Uniform and known mud density.
            e.  The vertical depth of casing shoe.

Question no. 86.  a.  Reaches the surface.

Question no. 87.  a.  5 bar.

Question no. 88.  Answer: 38 minutes.

Question no. 89.  c.  After WOC and drilling out casing shoe plus some 2 to 5 meter of new hole.

Question no. 90.  b.  53 m.

Question no. 91.  c.  73 bar on the casing gauge.

Question no. 92.  a.  54 bar on the drill pipe gauge.

Question no. 93.  b.  Monitoring the mud volume in the mud tanks.

Question no. 94.  b.  Glycol.
            e.  Methanol.

Question no. 95.  b.  When the bit is a long way off bottom without any etc..
            d.  When the bit is on bottom and the non-return valve (float) etc.

Question no. 96.  c.  33 bar.

Question no. 97.  d.  53 bar.

Question no. 98.  b.  The pressure decreases when the gas kick is circulated into the casing shoe.

Question no. 99.  c.  The pressure stay roughly steady while gas reaches surface.

Question no. 100.  b.  1,83 sg
Question no. 101.  
c. Pit gain expected from slug should have been calculated. If the increase is greater, shut the well in and check for pressure.

Question no. 102.  
c. BOP choke line valve(s) closed, choke line open to poor boy degasser, remote adjustable choke open.

Question no. 103.  
c. Pick up off bottom, shut down pumps, open BOP choke line valve(s), close BOP, and Close the choke, record pressures.

Question no. 104.  
d. Stab inside BOP and close it, close BOP, open BOP choke line valve(s), record casing pressures against closed choke.

Question no. 105.  
d. Dry gas.

Question no. 106.  
c. Bleed off through the choke and keep 18 bar plus a few psi safety margin on drill pipe pressure gauge.

Question no. 107.  
c. The maximum pressure that the formation below the casing shoe will withstand.

Question no. 108.  
b. Equal to the initial shut in drill pipe pressure.

Question no. 109.  
Answer: 44 bar

Question no. 110.  
a. Circulate bottoms up before making the next connection.

d. Reduce connection time to a minimum.

Question no. 111.  
c. Use the volumetric method until the influx is above the washout and continue circulating.

Question no. 112.  
c. The choke opening should be reduced.

Question no. 113.  
a. Prior to drilling out of a casing shoe

b. At the beginning of every crew change.

c. When the mud weight is changed.

Question no. 114.  
d. Top up the well with drill water and record the volume used.

Question no. 115.  
b. A small difference between the fracture gradient and the mud hydrostatic pressure.

d. A long section of open hole.

f. A large kick influx.

Question no. 116.  
b. The pressure that can be applied in addition to the mud column without losing mud or bursting the casing.

Question no. 117.  
c. Use the mud hydrostatic pressure to control the formation pore pressure.
Question no. 118.  d. Pull off bottom and make a flow check. If well is stable circulate bottoms up with reduced circulating rate with no overflow on the shakers. Make flow checks a few times while circulating the well clean.

Question no. 119.  b. Limit drilling to a low rate of penetration.
               d. Circulate while pulling out of the hole.

Question no. 120.  b. Use a mud with high viscosity.
               c. Pull the drill string through tight spots without circulating.
               d. Pull out of hole with high speed.

02. Pressure gauge answers

02.01. Drillers Method Subsea

2.  B: The pump rate is 27 SPM. Choke line friction 9 bar. Pcsg = (33-9=24 bar) A

3.  B: The pump rate has reached SPM. Pcsg is still too low (20 bar). The high Pdp 51 bar may be the result of a plugged nozzle (+ 8 bar).

4.  B: Both Pdp 0 43 bar and Pcsg = 19 bar is too low.

5.  E: All Ok. SPM = 30, Pdp = ICP = 45 bar Pcsg = IDCP = 22 bar. The focus is now turned towards the DPP gauge.

6.  A: Pdp = 51 bar, 6 bar to high.

7.  C: The kick has not been properly circulated. Pdp = 24 bar < Pcsg = 30 bar. There is still kick fluid in the well.


11. E: All Ok, continue. The well is filled with 1.70 dg kill mud. Pcsg = 0 bar. The choke is fully open. Pdp = 36 bar. There is an increase on the DP gauge because the choke line is filled with kill mud and circulates with 30 SPM. Increase will be a new SR with 1,70 kill mud.
02.02. Wait and weight method subsea

2. **C**: Reduce pump rate. Pump rate too high at 32 Spm, and corresponding pressure is too high.

3. **A**: Pump pressure should read 39 bar, open the choke to reduce pressure

4. **B**: The well is underbalanced at 1 bar, close the choke.

5. **E**: All ok

6. **C**: According to the killsheet, killmud is at bit. Pumps are stopped and well closed. Gauges show that Knw has the right value. Start circulating after the correct procedure has been done.

7. **E**: All ok

8. **A** = **D**: Pressure fluctuating, Kelly hose vibrating. There is a problem with mud pump. **B** = **A**: Stop pump, close the well. Change pump and use parameters from before the incident.

9. **A**: Drill pipe pressure to high, Fcp should be 24 bar

10. **E**: All ok, Fcp =26 bar

11. **E**: All looks normal, stop the pump, close and check the well.
02.03. Drillers method surface

2. **D**: Increase pump rate, pump rate is too low, 31 Spm. Csg pressure too low. Close on the choke

3. **B**: Still initial start-up, with focus on Csg pressure which is too low. Close the choke.

4. **E**: All ok – pump rate at kill rate and Csg pressure at 48 bar. Continue with constant Dp pressure = ICP

5. **A**: Dp pressure too high. Open the choke.

6. **C**: According to kill sheet, the kick should be circulated out. The well is closed but the Dp and Csg gauges doesn’t show the same values. Still gas in the well.

7. **A = C** Dp pressure increase but not Csg pressure. Nozzle plugged.  
   **B = C** All ok - continue

8. **E**: Continue – all ok. High Dp pressure due to plugged nozzle. Csg pressure = SIDPP pressure indicating clean well. Csg pressure is constant.

9. **A**: Open the choke. Dp = 58 bar.

10. **E**: Continue – all ok.

11. **A**: Open the choke. Dp pressure too high.

12. **C**: All looks ok. Close in well and observe pressure.
02.04. Wait and weight method surface

2. C: Pump rate too high, 38 Spm and the corresponding pressure is too high. Reduce pump rate.

3. E: Continue - all ok

4. A: Open the choke.

5. E: Continue - all ok

6. C: According to killsheet, killmud are at bit. Pumps are stopped and well closed. Gauges show Kmw right value. Correct start up holding constant Csg pressure.

7. E: Continue – all ok

   B = A: Stop the pump and close the well. Evaluate situation

9. A: Dp pressure too high, Fcp = 22 bar due to washed out nozzle. Open the choke.

10. E: Continue - all ok. FCP = 24 bar

11. C: Stop pump, close well and observe pressures
03. Killsheet exercises

The answers are subject to that IWCF Kill sheets are used, including the formulas given in the Kill sheets. The majority of responses are given in multiple choices, some even within a range. This means that it can either be several answers to the same question or the answer lies within a range. This is done in order to approach the way IWCF gives the answers and to take away the minor differences due to rounding.

03.01. Subsea well - exercise 1

What is the Pressure Safety Margin at the shoe when the well is first closed-in? Answer......67,7.......Bar

How many strokes to pump killmud from surface to bit? Answer......1505-1515....Strokes

How many strokes to pump the kick inside casing shoe? Answer.....860 - 870.......Strokes

Calculate the circulation time of killmud from surface, down the string, back up annulus to choke Answer...159 -161....Minutes

Calculate how many strokes to displace the riser? Answer.....1710-1720.........Strokes

Calculate KMW Answer......1,40...............Sg

Calculate ICP Answer........53.............Bar

Calculate FCP Answer......25..............Bar

Calculate MAASP after well is displaced to killmud? Answer.......93,1............Bar.

What will IDCP be after circulation is established correct? Answer.........35............Bar

What is the required mud weight to drill with, including riser margin (with killmud)? Answer......1,43............Sg
03.02. Subsea well - exercise 2

What is the Pressure Safety Margin at the shoe when the well is first closed-in? Answer......65,9......Bar.

Calculate KMW Answer......1,53......Sg.

Calculate pump strokes from surface to bit? Answer......1737 - 1747......Strokes

Calculate ICP Answer......61.........Bar

Calculate FCP Answer......28.........Bar

What will IDCP be after establishing circulation correct? Answer......28.........Bar

Calculate how many strokes needed to circulate the kick inside the casing shoe Answer......3219-3229......Strokes

Calculate the total time for circulating the kick out of the well? Answer.....6...Hours 55-57 min.

Calculate strokes to displace the riser? Answer....1930 - 1940.........Strokes

Calculate MAASP after well is displaced to killmud? Answer......38,9.........Bar.

Calculate the riser margin after displacing the well to killmud? Answer......0,04.........Sg
03.03. Surface well - exercise 3

What is the Pressure Safety Margin at the shoe when the well is first closed-in?  Answer.....67,6........Bar

How many pump strokes to displace the string?  Answer.....1505 -1515......Strokes

How many pump strokes to circulate the kick inside casing shoe  Answer......861 - 871.......Strokes

Calculate the total time for circulating the killmud down the string, up annulus to choke  Answer.....164 - 166......Minutes

Calculate KMW  Answer......1,40.................Sg.

Calculate ICP  Answer...........53........Bar

Calculate FCP  Answer......25.................Bar

What is MAASP after displacing well to killmud?  Answer........93,1.........Bar.

What is the kick gradient?  Answer......0,043.........Bar / m.

What is the reduction on drill pipe pressure per 100 strokes while displacing the string to killmud?  Answer.....1,8… Bar / 100 strokes.
03.04. Surface well - exercise 4

What is initial MAASP before shut-in? Answer: 65,9 Bar.

Calculate KMW Answer: 1,53 Sg.

How many strokes to displace the drill string to kill mud? Answer: 1737-1747 Strokes.

Calculate ICP Answer: 61 Bar.

Calculate FCP Answer: 28 Bar.

How many strokes to circulate the kick inside the casing shoe? Answer: 3219-3229 Strokes.

Calculate total circulation time displacing the well to kill mud Answer: 7h 17-19 minutes.

What is the reduction on drill pipe pressure per 100 strokes while displacing the string to kill mud? Answer: 1,8 Bar / 100 strokes.

What is MAASP after displacing the well to kill mud? Answer: 38,4 Bar.
### 03.05. Various exercises no 5-30 – answers

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<td>B</td>
</tr>
<tr>
<td>30</td>
<td>B/D</td>
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01. Valves installed in the drill string

Question 1:  
- 8. Valve
- 3. Upper body
- 7. Seat
- 9. Lower body
- 6. Release tool body
- 4. Release rod

Question 2:  
d. A Kelly cock in open position and an inside BOP above it.

Question 3:  
a. Must not be run in the well in closed position.
- c. Very often leaks through valve crank sleeve.
- e. Must have the right key to be operated.

Question 4:  
a. Must be pumped in open position to enable reading SIDPP.
- d. Is kept in open position by a bolt screwed in with a T-handle.
- e. It is not possible to run wire line through the valve.

Question 5:  
c. Maximum expected surface pressure, but not higher than the working pressure of the BOP.

Question 6:  
a. D Circulation down the annular and up the drill pipe is not possible.
- b. D Reading of shut in drill pipe pressure (SIDPP).
- c. A The valve prevents formation fluids from entering the drill pipe.
- d. D Greater strain on the formation when the drill pipe is run in.
- e. D The drill pipe must be filled when run in.

Question 7:  
5. Ball valves
- 3. Lower seat.
- 4. Upper seat.
- 1. Body
- 2. Crank
02. Blowout preventers

Question 1:  b. No

Question 2:  b. No

Question 3:  a. Yes

Question 4:  b. No

Question 5:  b. No

Question 6:  a. Yes

Question 7:  b. No

Question 8:  a. Yes

Question 9:  a. Yes

Question 10:  b. The bore of the annular and pipe rams

Question 11:  f. Maximum expected surface pressure.

Question 12:  a. Perform an operating test on the BOP.

Question 13:  b. After having set casing

   c. After a change of the components on the BOP.

Question 14:  A:  c. 150 % of the working pressure.

   B:  4  Riser connector

   5  Control pod

   1  Accumulator bottles

   3  Flex joint

   2  Flexible hoses

Question 15:  b. No

Question 16:  a. Yes

Question 17:  a. Yes

Question 18:  a. Yes

Question 19:  d. Grade G–105 premium drill pipe, tensile strength: 436150 lbs. / 194.000 daN

Question 20:  a. Close upper pipe ram, then pressure up to 264 bar/3828 psi pressure between upper pipe ram and middle pipe ram. And then open middle pipe ram.
03. Annulars and rams

Question 1:
   a. Lowest closing pressure is achieved by connecting the closing chamber and the secondary chamber.
   b. The opening forces that affect the ram from the mud pressure in the riser can be balanced by using the secondary chamber.

Question 2:
   6. Opening chamber
   8. Primary closing chamber
   9. Secondary Closing Chamber/Balance Chamber
   3. Packer element
   7. Piston
   5. Opening Chamber Head

Question 3:
   c. Pipe rams

Question 4:
   4. Opening chamber
   6. Closing chamber
   2. Packing unit
   5. Piston
   3. Screwed head

Question 5:
   1. Top seal
   2. Ram block
   3. Front packer.

Question 6:
   b. The temperature limit of the packer unit.
   c. The type of mud to be used in the well.

Question 7:
   a. To prevent damage on the rubber between the drill pipe and the ram block when the pipe rams are in a closed position and the well is under pressure.
   c. To push forth the rubber when the seal face is worn.
Question 8:
  a. No

Question 9:
  a. A pipe ram can be used to hang off the drill pipe.
  c. When the pipe ram is closed, the well pressure will help keeping it closed.
  d. The pipe ram is made such that it only holds full working pressure from below when the ram is closed.

Question 10:
  13 Intermediate flange.
  5 Housing Locking Screw.
  1 Bonnet Seal.
  12 Ram Change Cylinder.
  9 Ram Change Piston, open.
  6 Bolt, Bonnet.

Question 11:
  6 Lower blade
  4 Lower ram block
  1 Upper ram block
  3 Lower Rubber
  7 Upper ram block holder

Question 12:
  2 – 4 Ram Assembly
  11 Operating Cylinder.
  10 Operating Piston.
  7 Locking Screw.
  8 Bonnet.
  3 Body.

Question 13:
  c. The primary packing of the ram shaft seal leaks. Secure the well and change the primary packing immediately.

Question 14:
  c. The relation between the pressures required to close the pipe ram and the pressure at the well head.
Question 15:  
4. Seal Top  
3. Seal Face  
2. Block  
1. Holder Ram  
5. Screw Retracting

Question 16:  
2. Side packers  
3. Ram face packer  
1. Top seal  
4. Upper ram block  
5. Lower ram block

Question 17:  
3. Opening hydraulic port  
1. Pusher plate  
2. Closing hydraulic port  
5. Vent  
4. Operating piston

Question 18:  
5. Packer Insert  
3. Donut  
2. Opening side of Piston  
1. Packer  
4. Closing side of Piston

04. Choke manifolds

Question 1:  
To regulate pressure and circulate/kill a kick

Question 2:  
2 - 3 - 4 - 8 - 9 - 10 - 11 - 13 - 15 - 17 - 22

Question 3:  
1 - 3 - 5 - 6 - 7 - 8 - 9 - 10 - 13 - 14 - 16 - 19 - 20
05. Control system for a surface BOP

Question 1: b. 30 Seconds

Question 2: b. 45 Seconds

Question 3: c. 45 Seconds

Question 4: a. 30 Seconds

Question 5: c. 30 Seconds

Question 6: a. 30 Seconds

Question 7: 17 Accumulators.
9 Check valve.
10 Electric motor driven triplex or duplex pump assembly
22 4-way valves
16 Accumulator shut-off valve.

Question 8: 20 Manifold reducing and regulating valve.
28 Accumulator pressure gauge
6 Air operated hydraulic pumps.
31 Pneumatic pressure transmitter
8 Suction strainer.
26 Panel-unit selector

Question 9: 29 Manifold pressure gauge.
18 Accumulator relief valve.
27 Annular pressure reducing and regulating valve – air operated
11 Automatic hydro-electric pressure switch.
30 Annular preventer pressure gauge.
4 Automatic hydro-pneumatic pressure switch.

Question 10: b. Accumulator pressure
c. Annular pilot-/read back pressure

Question 11: a. Manifold pilot-/read back pressure
b. Accumulator pressure
Question 12:  d. None of the above mentioned functions can be operated from the panel.

Question 13: a. Leakage in accumulator manifold

Question 14:  c. Leakage in manifold regulator.
          e. Leakage in the bypass valve.

Question 15: d. Faulty annular regulator

Question 16:  d. 207 bar/3000 psi

Question 17:  a. 103 bar/1500 psi

Question 18:  a. 41 – 103 bar/600 - 1500 Psi


Question 22:  a. True

Question 23:  a. The regulator cannot be operated from the panel on drill floor.
          c. All functions on BOP can be closed or opened.

Question 24:  d. There is a blockage in the lines to the BOP.

Question 25:  c. Hydraulic leakage in the lines to the BOP

Question 26:  c. There are errors on the indicator lights.

Question 27: b. To bypass the regulated manifold pressure and use accumulator pressure

Question 28:  b. 2 minutes or less.

Question 29:  c. 4/3 valves center position has closed the entry on the pressure side…etc..

Question 30:  c. 4/3 valve have four connections.
          d. 4/3 valve can be set in three positions.
          f. 4/3 valve can be manually operated

Question 31: No.: 3 - 4 - 6 - 7 - 9
06. Accumulators

Question 1: c. The volume that can be taken out of the bottles between max pressure…. etc.

Question 2: b. 638,4 l.

Question 3: c. Nitrogen

Question 4: b. 90 gallons

Question 5: d. To be able to close the rams of the BOP if the energy supply disappears.
   e. To reduce the closing time of the BOP.

07. Diverter systems

Question 1: b. A low pressure annular with a large bore
   c. A vent line of large diameter.

Question 2: 5. Flow line seals
   4. Insert packer
   2. Closing port
   1. Packer element locking bolt
   3. Outer Packer

Question 3: a. Open D, close B, close F

08. Mud gas separator (Poor boy)

Question 1: Correct answer: 4 bar

Question 2: b. Vent line H3 and the bore of vent line D3.
09. Mechanical couplings

Question 1:  4

Question 2:  2

Question 3:  b. 6B

Question 4:  a. Type BX

Question 5:  b. Type RX
c. Type BX
Section 1. Filled-in Kill Sheet Exercises - Gauge Problem Actions.

Gauge Problem Exercises are constructed from a completed kill sheet ‘filled in’ with all relevant volume and pressure calculations.

Each question is based on the strokes, pump rate, drill pipe and casing gauge readings at a specific point in time during a well kill operation. Any one of a combination of these readings could indicate the action required. Options are shown in the multiple-choice answers.

The casing and/or drill pipe pressures will only be relevant to the action if –

- The casing and/or drill pipe pressures given in the question are below the expected pressures, or
- The casing and/or drill pipe pressure given in the question is 5 bar or more above the expected pressures.

Section 2. Calculation Formulas

**Abbreviations Used in this Document**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>bar</td>
<td>Bar (pressure)</td>
</tr>
<tr>
<td>bar/m</td>
<td>Bar per metre</td>
</tr>
<tr>
<td>bar/hr</td>
<td>Bar per hour</td>
</tr>
<tr>
<td>BHP</td>
<td>Bottom hole pressure</td>
</tr>
<tr>
<td>BOP</td>
<td>Blowout Preventer</td>
</tr>
<tr>
<td>kgf/I</td>
<td>Kilogram per litre</td>
</tr>
<tr>
<td>l</td>
<td>Litre</td>
</tr>
<tr>
<td>l/m</td>
<td>Litre per metre</td>
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</tr>
<tr>
<td>l/stroke</td>
<td>Litre per stroke</td>
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<td>LOT</td>
<td>Leak-off Test</td>
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<td>m</td>
<td>Metre</td>
</tr>
<tr>
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<td>Metre per hour</td>
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<tr>
<td>m/min</td>
<td>Metre per minute</td>
</tr>
<tr>
<td>MAAASP</td>
<td>Maximum Allowable Annular Surface Pressure</td>
</tr>
<tr>
<td>SICP</td>
<td>Shut in Casing Pressure</td>
</tr>
<tr>
<td>SIDPP</td>
<td>Shut in Drill Pipe Pressure</td>
</tr>
<tr>
<td>SPM</td>
<td>Strokes per minute</td>
</tr>
<tr>
<td>TVD</td>
<td>True Vertical Depth</td>
</tr>
<tr>
<td>0.0981</td>
<td>Constant factor</td>
</tr>
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</table>

1. **HYDROSTATIC PRESSURE** (bar)
   
   Mud Density (kgf/I) × 0.0981 × TVD (m)

2. **PRESSURE GRADIENT** (bar/m)
   
   Mud Density (kgf/I) × 0.0981

3. **DRILLING MUD DENSITY** (kgf/I)
   
   Pressure (bar) = TVD (m) × 0.0981
   
   or
   
   Pressure (bar) / TVD (m) × 0.0981
4. FORMATION PORE PRESSURE (bar)
   Hydrostatic Pressure in Drill String (bar) + SIDPP (bar)

5. PUMP OUTPUT (l/min)
   Pump Displacement (l/stroke) x Pump Rate (SPM)

6. ANNULAR VELOCITY (m/min)
   Pump Output (l/min) / Annular Capacity (l/min)

7. EQUIVALENT CIRCULATING DENSITY (kg/l)
   \[\text{Annular Pressure Loss (bar) - TVD (m) x 0.0981} + \text{Fluid Density (kg/l)}\]
   or
   \[\frac{\text{Annular Pressure Loss (bar)}}{\text{TVD (m) x 0.0981}} + \text{Fluid Density (kg/l)}\]

8. MUD DENSITY WITH TRIP MARGIN INCLUDED (kg/l)
   \[\text{Safety Margin (bar) - TVD (m) x 0.0981} + \text{Mud Density (kg/l)}\]
   or
   \[\frac{\text{Safety Margin (bar)}}{\text{TVD (m) x 0.0981}} + \text{Mud Density (kg/l)}\]

9. NEW PUMP PRESSURE (bar) WITH NEW PUMP RATE approximate
   \[\text{Old Pump Pressure (bar)} \times \left(\frac{\text{New Pump Rate (SPM)}}{\text{Old Pump Rate (SPM)}}\right)^2\]

10. NEW PUMP PRESSURE (bar) WITH NEW FLUID DENSITY approximate
    \[\text{Old Pump Pressure (bar)} \times \frac{\text{New Mud Density (kg/l)}}{\text{Old Mud Density (kg/l)}}\]

11. MAXIMUM ALLOWABLE FLUID DENSITY (kg/l)
    \[\text{Surface LOT Pressure (bar)} - \text{Shoe TVD (m) x 0.0981} + \text{LOT Mud Density (kg/l)}\]
    or
    \[\frac{\text{Surface LOT Pressure (bar)}}{\text{Shoe TVD (m) x 0.0981}} + \text{LOT Mud Density (kg/l)}\]

12. MAASP (bar)
    \[\text{Maximum Allowable Mud Density (kg/l)} - \text{Current Mud Density (kg/l)} \times 0.0981 \times \text{TVD (m)}\]

13. KILL MUD DENSITY (kg/l)
    \[\text{SIDPP (bar)} - \text{TVD (m) x 0.0981} + \text{Original Mud Density (kg/l)}\]
    or
    \[\frac{\text{SIDPP (bar)}}{\text{TVD (m) x 0.0981}} + \text{Original Mud Density (kg/l)}\]

14. INITIAL CIRCULATING PRESSURE (bar)
    \[\text{Kill Rate Circulating Pressure (bar)} + \text{SIDPP (bar)}\]
15. FINAL CIRCULATING PRESSURE (bar)

\[
\frac{\text{Kill Mud Density (kg/l)}}{\text{Original Mud Density (kg/l)}} \times \text{Kill Rate Circulating Pressure (bar)}
\]

16. BARYTE REQUIRED TO INCREASE DRILLING MUD DENSITY (kg/l)

\[
\frac{[\text{Kill Mud Density (kg/l)} - \text{Original Mud Density (kg/l)}]}{4.2} \times 4.2
\]

17. GAS MIGRATION RATE (m/hr)

\[
\frac{\text{Rate of Increase in Surface Pressure (bar/hr)}}{\text{Drilling Mud Density (kg/l)} \times 0.0981}
\]

18. GAS LAWS

\[
P_1 \times V_1 = P_2 \times V_2
\]

\[
P_2 = \frac{P_1 \times V_1}{V_2}
\]

\[
V_2 = \frac{P_1 \times V_1}{P_2}
\]

19. PRESSURE DROP PER METRE TRIPPING DRY PIPE (bar/m)

\[
\frac{\text{Drilling Mud Density (kg/l)} \times 0.0981 \times \text{Metal Displacement (l/m)}}{\text{Riser or Casing Capacity (l/m)} - \text{Metal Displacement (l/m)}}
\]

20. PRESSURE DROP PER METRE TRIPPING WET PIPE (bar/m)

\[
\frac{\text{Drilling Mud Density (kg/l)} \times 0.0981 \times \text{Closed End Displacement (l/m)}}{\text{Riser or Casing Capacity (l/m)} - \text{Closed End Displacement (l/m)}}
\]

21. LEVEL DROP PULLING REMAINING COLLARS OUT OF HOLE DRY (metre)

\[
\text{Length of Collars (m)} \times \text{Metal Displacement (l/m)}
\]

\[
\text{Riser or Casing Capacity (l/m)}
\]

22. LEVEL DROP PULLING REMAINING COLLARS OUT OF HOLE WET (metre)

\[
\text{Length of Collars (m)} \times \text{Closed End Displacement (l/m)}
\]

\[
\text{Riser or Casing Capacity (l/m)}
\]

23. LENGTH OF TUBULARS TO PULL DRY BEFORE OVERBALANCE IS LOST (metre)

\[
\frac{\text{Overbalance (bar)} \times [\text{Riser or Casing Capacity (l/m)} - \text{Metal Displacement (l/m)}]}{\text{Drilling Mud Gradient (bar/m)} \times \text{Metal Displacement (l/m)}}
\]

24. LENGTH OF TUBULARS TO PULL WET BEFORE OVERBALANCE IS LOST (metre)

\[
\frac{\text{Overbalance (bar)} \times [\text{Riser or Casing Capacity (l/m)} - \text{Closed End Displacement (l/m)}]}{\text{Drilling Mud Gradient (bar/m)} \times \text{Closed End Displacement (l/m)}}
\]

25. VOLUME TO BLEED OFF TO RESTORE BHP TO FORMATION PRESSURE (litre)

\[
\frac{\text{Increase in Surface Pressure (bar)} \times \text{Influx Volume (l)}}{\text{Formation Pressure (bar)} - \text{Increase in Surface Pressure (bar)}}
\]

26. SLUG VOLUME (litre) FOR A GIVEN LENGTH OF DRY PIPE

\[
\frac{\text{Length of Dry Pipe (m)} \times \text{Pipe Capacity (l/m)} \times \text{Drilling Fluid Density (kg/l)}}{\text{Slug Density (kg/l)} - \text{Drilling Fluid Density (kg/l)}}
\]
27. **PIT GAIN DUE TO SLAG U-TUBING (litre)**

\[
\text{Slug Volume (l)} \times \left( \frac{\text{Slug Density (kg/l)}}{\text{Drilling Fluid Density (kg/l)}} - 1 \right)
\]

28. **RISER MARGIN (kg/l)**

\[
\frac{[\text{Air Gap (m)} + \text{Water Depth (m)}] \times \text{Mud Density (kg/l)} - [\text{Water Depth (m)} \times \text{Sea Water Density (kg/l)}]}{\text{TVD (m)} - \text{Air Gap (m)} - \text{Water Depth (m)}}
\]

29. **HYDROSTATIC PRESSURE LOSS IF CASING FLOAT FAILS (bar)**

\[
\frac{\text{Mud Density (kg/l)} \times 0.0001 \times \text{Casing Capacity (l/m)} \times \text{Unfilled Casing Height (m)}}{\text{Casing Capacity (l/m)} + \text{Annular Capacity (l/m)}}
\]