40. Using the diagram on the previous page, identify the following parts:

Hydroelectric pressure switch 11
Accumulator shut-off valve 16
Accumulator pressure gauge 28
Unit/remote switch 26
Manifold by-pass valve (high / low) 23
Triplex pump check valve 15

41. The characters “6 BX” stamped on a flange represents the........

A. Serial number
B. Pressure rating
C. Type (Correct Answer)
D. Size

42. What is meant by the closing ratio for a ram BOP?

A. Ratio between closing and opening volume
B. Ratio between closing and opening time
C. Ratio of wellhead pressure to the pressure required to close the BOP (Correct Answer)

43. Accumulators are precharged with what type of gas?

NITROGEN

44. The main function of the choke in the overall BOP system is......

A. To divert contaminant to the burning pit
B. To hold back pressure while circulating out a kick (Correct Answer)
C. To divert fluid to the mud pit
D. To prevent the loss of mud resulting from gas expansion
E. To perform a soft shut in
45. Why should the side outlet below the test plug be kept in the open position while testing a surface BOP stack?

A. To prevent potential damage to the casing and/or open hole (Correct Answer)
B. To prevent extreme hook loading.
C. To allow easy release of the plug

46. What is the normal precharge for the accumulator bottles on a 3000 psi accumulator?

A. 1000 psi (Correct Answer)
B. 3000 psi
C. 1200 psi
D. 200 psi

47. From the diagram, identify the dimensions that determine the build up of pressure in the mud/gas separator. (TWO ANSWERS)

A. Vent line height (H3) (Correct Answer)
B. Separator height (H2)
C. Mud seal height (H1)
D. Inlet diameter (D2)
E. Primary vent diameter (D1) (Correct Answer)
48. Calculate the pressure at which gas blow through would occur. The mud weight is 12.5 ppg.

\[ 4.2 \text{ psi} \]

Equation #1 \[ HP = MW \text{ ppg} \times 0.052 \times \text{Height ft} \]

\[ 12.5 \times 0.052 \times 6.5 = 4.2 \text{ psi} \]
49. Of the items shown at right, which one determines at what pressure the degasser will unload?

A. D1  
B. D2  
C. H1 (Correct Answer)  
D. H3  
E. H1 & H3  
F. D2 & D1 & H3
50. Based on the information given at right, what is the rated working pressure of the atmospheric degasser?

7.36 psi

*Equation #1 HP = MW ppg x 0.052 x Height ft
11.8 ppg x 0.052 x 12 ft = 7.36 psi*
51. On a Cameron “u” type ram preventer, in which position does the 4-way valve have to be in to open the bonnet after backing off the bonnet bolts?

A. Open  
B. *Closed (Correct Answer)*  
C. Neutral  
D. Either position will work  

52. Which ram type preventer on a Cameron 13 5/8", 10,000 psi working pressure BOP stack is equipped with a thicker intermediate flange?

A. Pipe rams  
B. Blind rams  
C. *Shear rams (Correct Answer)*  
D. Variable bore rams  

53. What would be the effect of fitting a 7 1/16” X 5000 psi flange to a 10,000psi working pressure rated BOP stack?

A. The stack rating would remain at 10,000 psi  
B. *The stack rating would decrease to 5000 psi (Correct Answer)*  
C. The stack rating would decrease to 7500 psi  

54. What is the purpose of the master control valve on an air operated remote BOP panel?

A. It activates the hydraulic fluid circuit at the panel  
B. *It activates the air circuit at the panel (Correct Answer)*  
C. It activates the electrical circuit for the “open/close” lights  
D. It adjusts the pipe ram closing pressure  

55. Where are the proximity (activating) switches for the BOP remote panel lights situated?

A. On the pressure gauge mounted on the remote control panel  
B. *On the accumulator (Correct Answer)*  
C. On the side of the BOP operating chambers  
D. On the remote control operating handles
56. On which ram operation would you be most likely to use the manifold by-pass valve (high / low)?
   
   A. Using variable bore rams  
   B. Using blind/shear rams (Correct Answer)  
   C. When using 5” S-135 drill pipe  
   D. When using 3 ½” G-105 drill pipe  

57. According to API RP-53, what is the minimum pressure at which the charging pumps start up?
   
   A. When accumulator pressure has decreased to less than 50% of the operating pressure  
   B. When accumulator pressure has decreased to less than 75% of the operating pressure  
   C. When accumulator pressure has decreased to less than 90% of the operating pressure (Correct Answer)  

58. Select THREE items of equipment that may warn of increasing formation pressure while drilling overbalanced.
   
   A. ROP recorder (Correct Answer)  
   B. Pump stroke counter  
   C. Gas detector (Correct Answer)  
   D. Casing pressure gauge  
   E. Mud temperature recorder (Correct Answer)  
   F. Standpipe pressure gauge  

59. Why are some choke manifolds equipped with a glycol or methanol injection system?
   
   A. To help prevent hydrate formation while circulating out a kick (Correct Answer)  
   B. To help test fluid flow better  
   C. To allow the use of all types of adjustable chokes  
   D. To help prevent a hydraulic shock if gas suddenly arrives at the surface  

60. A test cup for 9 5/8” 43.5 lb/ft casing is used to test a BOP stack to a pressure of 10,000 psi using 5” drill pipe. The area of the test cup subject to pressure is 42.4 square inches. What is the minimum grade of drill pipe that could be used and will withstand the stress of testing?
   
   A. Grade E drill pipe having a tensile strength of 311,200 lbs  
   B. Grade X-96 drill pipe having a tensile strength of 394,200 lbs  
   C. Grade S drill pipe having a tensile strength of 560,100 lbs  
   D. Grade G drill pipe having a tensile strength of 443,096 lbs (Correct Answer)  

\[
\text{Pressure x Area = Force} \\
10,000 \text{ psi} \times 42.4 \text{ sq. in.} = 424,000 \text{ lbs}
\]
61. What is meant by “the useable fluid volume of an accumulator?”

A. The total volume of hydraulic fluid that can be stored in the accumulator tank
B. The total volume of fluid that can be stored in the accumulator bottles
C. The total volume of fluid that is recoverable from the bottles between the accumulator operating pressure and the minimum operating pressure (Correct Answer)
D. The total volume of fluid that is recoverable from the bottles between the accumulator operating pressure and the precharge pressure
E. The total volume of fluid that is recoverable from the bottles between the accumulator operating pressure and 750 psi above precharge pressure

62. What are the main components of a diverter system? (TWO ANSWERS)

A. A low pressure annular preventer with a large internal diameter (Correct Answer)
B. A vent line of sufficient length to allow gas to be safely vented from the separator
C. A high pressure ram preventer with a large internal diameter
D. A vent line with manually operated valves
E. A vent line of sufficient diameter to permit safe venting and proper disposal of flow from the well (Correct Answer)

63. What should be considered for the BOP rated working pressure according to API RP-53?

A. Maximum anticipated bottom hole pressure
B. Maximum anticipated formation pressure
C. Maximum anticipated surface pressure (Correct Answer)
D. Maximum anticipated drilling mud hydrostatic pressure
E. Maximum anticipated MAASP

64. What is the primary function of the weep hole (drain hole, vent hole) on a Ram BOP? (Select ONE answer)

A. To show that the ram body rubbers are working
B. To show that the mud seal on the piston rod is leaking (Correct Answer)
C. To show that the bonnet seals are leaking
D. To show that the closing chamber pressure is excessive
65. Identify the ONE ram locking device from the list below that does NOT allow for self-feeding of ram packers to allow for packer wear.

A. Shaffer Ultralock  
B. Shaffer Poslock (Correct Answer)  
C. Hydril MPL Lock  
D. Cooper (Cameron) Wedgelock  
E. Koomey Autolock

66. From the list below, identify the ring gaskets that are pressure energized. (FOUR ANSWERS)

A. Type RX (Correct Answer)  
B. Type BX (Correct Answer)  
C. Type AX (Correct Answer)  
D. Type R Oval  
E. Type R Octagonal  
F. Type CX (Correct Answer)

67. Which dimension from the list below is used to identify the Nominal Flange Size?

A. Throughbore ID (Correct Answer)  
B. Flange OD  
C. Diameter of raised face  
D. OD of ring groove  
E. Bolt circle diameter
68. Identify the following parts of this pipe ram block.

- Rubber (D)
- Retaining Screw (F)
- Block (C)
- Holder (E)
- Top Seal (A)
- Retracting Screw (B)
69. Identify the following shear ram block components:

- Upper Holder 1
- Lower Holder 2
- Upper Rubber 5
- Lower Shear Blade 7
- Upper Ram Block 3
- Lower Ram Block 4
- Lower Rubber 6
- Retainer Screw 8
70. The rig is now working for an operator who requires a different stack (13-5/8” x 15,000 psi). This operator’s policy is to provide sufficient usable hydraulic fluid to function all BOP components with a minimum pressure remaining to close against full rated BOP working pressure.

The number of gallons to “function” all BOP components = 150 gallons for this stack.

The BOP “closing ratio” is 10.6 to 1
Precharge pressure = 1,000 psi
System pressure = 3,000 psi

How many 10 gallon bottles (cylinders) are required to store those 150 gallons of hydraulic fluid?

A. **30 - 10 gallon bottles (Correct Answer)**
B. 36 - 10 gallon bottles
C. 41 - 10 gallon bottles
D. 51 - 10 gallon bottles

In a system with 1000 precharge and 3000 system pres each bottle has 5 gallons of usable fluid. **150 bottles divided by 5 gallons of usable fluid = 30 bottles**

71. All ram BOP’s are designed to close (and hold closed) on full rated pressure with 1500 psi hydraulic operating pressure?

A. True
B. **False (Correct Answer)**

72. Ram type BOPs are designed to open in a situation where rated working pressure is contained below the rams and mud hydrostatic pressure to the flow line is above the rams; for instance in a stripping situation.

A. True
B. **False (Correct Answer)**
73. Identify the following components from the illustration provided on the previous page:

A  16  Accumulator shut-off Valve (Bank Isolator valve)
B  17  Accumulator Bottles
C  20  Manifold Regulator (Pressure reducing and regulating valve)
D  27  Annular Regulator (Pressure reducing and regulating valve)
E  34  Air Filter
F  2   Air Lubricator
G  11  Electric Pressure Switch
H  4   Hydro-Pneumatic Pressure Switch
I  22  Three Position/Four-Way Control Valve
J  23  Manifold Regulator Override Valve (By-pass valve)
K  12  Electric Motor Starter
L  9   Check Valve for Air Operated Pump
M  30  Annular Preventer Pressure Gauge
N  29  Manifold Pressure Gauge
O  28  Accumulator Pressure Gauge
P  15  Check Valve for Triplex Pump
Q  8   Strainer for Air Operated Pump
R  14  Strainer for the Triplex Pump
S  18  Accumulator Pressure Relief Valve
T  24  Manifold Pressure Relief Valve
U  26  Unit /Remote switch
V  31-32-33 Pressure Transducers/Transmitter
W  6   Air Pumps
74. The wait and weight method of well control is being used on a floating rig. After all the influx is out of the well, the drill pipe pressure increases to a level higher than the final circulating pressure even though the choke is wide open. What is the cause of the increase in pressure?

A. An error was made in calculating the final circulating pressure
B. If the casing pressure is not increasing then a bit nozzle is plugged
C. **Because of the U-tube effect, the choke line friction pressure is now showing up on the drill pipe pressure gauge (Correct Answer)**
D. Hydrates are forming in the drill string thus increasing drill pipe pressure

75. What can be done to reduce the problem in the previous question? (TWO ANSWERS)

A. **Reducing the pump rate will reduce choke line friction pressure which will reduce the amount of drill pipe pressure increase (Correct Answer)**
B. **Open the kill line and allow the mud to return to the surface through both the choke and kill lines. This reduces choke line friction and will reduce the amount of drill pipe pressure increase (Correct Answer)**
C. Use the excess pressure as a safety factor which will further guarantee killing the well on the 1st circulation
D. The extra pressure is of no concern and will not hurt anything

Use the following data to answer questions 76, 77 & 78. Assume the kill procedure to be conducted from a floating rig

- Vertical depth of the casing shoe: 6500 feet
- MAASP leak-off value with 9.5 ppg mud: 1350 psi
- Slow pump rate @ 30 spm through the riser: 800 psi
- Slow pump rate @ 30 spm through the choke line: 1050 psi
- Drilling fluid density: 10.6 ppg
- SIDPP: 540 psi
- SICP: 850 psi
- TVD at the time of the kick: 8900 feet

76. Calculate the required Initial Circulating Pressure

A. 600 psi
B. 790 psi
C. **1340 psi (Correct Answer)**
D. 1590 psi

*Equation #14 – ICP = SIDPP + Slow Rate Circulating Pressure*

\[
540 + 800 = 1340 \text{ psi}
\]
77. Calculate the required Final Circulating Pressure when the density of the kill fluid is 11.8 ppg.

A. 600 psi  
B. **891 psi (Correct Answer)**  
C. 946 psi  
D. 1170 psi

\[
\text{Equation #15 - FCP} = \frac{\text{Kill Mud ppg}}{\text{Original Mud ppg}} \times \text{Kill Rate Circulating psi} \times \frac{11.8}{10.6} \times 800 = 891 \text{ psi}
\]

78. Calculate the maximum allowable value on the annulus pressure gauge when establishing kill pump rate @ 30 spm at initiating kill operation.

A. **696 psi to 728 psi (Correct Answer)**  
B. 980 psi  
C. 1000 psi to 1066 psi

\[
\text{Equation #11 - MAMW ppg} = (\text{LOT psi} \div 0.052 \div \text{Csg shoe TVD ft}) + \text{OMW ppg} \\
(1350 \div 0.052 \div 6500) + 9.5 = 13.49 \text{ ppg} \\
\text{Equation #12 - MAASP psi} = (\text{MAMW ppg} - \text{Current MW ppg}) \times 0.052 \times \text{Csg shoe TVD ft} \\
(13.4 - 10.6) \times 0.052 \times 6500 = 976 \text{ psi} \\
\text{MAASP psi (976) - CLFP psi (250) = 726 psi}
\]

A floating drilling rig is drilling below 30 inch conductor. The information to answer questions 79 & 80.

- Water depth: 1465 feet  
- TVD from flow line: 2250 feet  
- Air gap: 80 feet  
- Sea water density: 8.5 ppg  
- Mud weight: 9.5 ppg

79. Calculate the reduction in BHP if the riser is disconnected at the wellhead housing on the seafloor.

**116** psi

\[
\text{HP of Riser before Disconnect} = 9.5 \text{ ppg} \times 0.052 \times (1465 + 80) = 763 \text{ psi} \\
\text{HP of SW after Disconnect} = 8.5 \text{ ppg} \times 0.052 \times 1465 = 647 \text{ psi} \\
\text{Reduction in HP} = 763 - 647 = 116 \text{ psi}
\]

80. Calculate the minimum drilling fluid density that will keep the well balanced with the riser disconnected.

**12.7** ppg

\[
\text{Feet of formation below mudline} = \text{TVD ft} - \text{Water Depth ft} - \text{Air Gap ft} = 2250 - 1465 - 80 = 705 \text{ ft} \\
\text{Equivalent MW ppg} = \left(\frac{116 \text{ psi}}{0.052} \div 705 \text{ ft} \right) + 9.5 \text{ ppg} = 12.66 \text{ ppg} = 12.7 \text{ ppg}
\]
A 17 ½” hole is being drilled below 30-inch conductor. Use the data below to answer questions 81 & 82.

<table>
<thead>
<tr>
<th>Water depth</th>
<th>650 feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor set @</td>
<td>1275 feet from rig floor</td>
</tr>
<tr>
<td>Air gap</td>
<td>60 feet</td>
</tr>
<tr>
<td>Sea water gradient</td>
<td>.445 psi/ft</td>
</tr>
</tbody>
</table>

81. From a previous well drilled the formation fracture gradient beneath the sea bed is estimated to be .62 psi/ft. Calculate the theoretical maximum mud weight that can be used in a static (non-circulating) condition without exceeding the formation strength.

\[ \text{SW gradient (.445) x Water Depth (650) = 289.25 psi} \]
\[ \text{Formation gradient (.62) x Formation Depth (565) = 350.3 psi} \]
\[ \text{Equation #11 - MAMW ppg = Frac Pressure ÷ 0.052 ÷ TVD ft} \]
\[ 639.55 \text{ psi ÷ 0.052 ÷ 1275 ft} = \text{9.64 ppg} \]

82. Calculate the above in the dynamic (circulating) condition with an annular pressure loss of 10 psi.

\[ \text{Equivalent Circ Density ppg = (Ann Press Loss ÷ 0.052 ÷ TVD ft) + OMW} \]
\[ (10 ÷ 0.052 ÷ 1275) - 9.64 = \text{9.49 ppg} \]

83. On a semi-submersible a kick is taken and the following data has been recorded after shut in pressures have stabilized.

- Well depth (RKB) 17,327 feet MD/15,678TVD
- Casing shoe (RKB) 15,245 feet MD/12,855 feet TVD
- Formation fracture gradient .8 psi/ft
- Mud weight 13.2 ppg
- Water depth 1080 feet
- Water density 8.6 ppg
- Pressure loss through riser 470 psi
- Pressure loss through choke line 670 psi
- SIDPP 510 psi
- SICP 800 psi

Calculate the margin between the initial dynamic MAASP and the initial choke pressure if the instructions are to maintain a 100 psi overbalance over and above formation pressure at the start of the well killing operation. Assume a circulating rate of 30 spm.

\[ \text{503 - 560 psi} \]
\[ \text{(Frac Grad – Mud Grad) x Csg shoe TVD = MAASP} \]
\[ (.8 - .6864) \times 12,855 \text{ ft.} = 1460 \text{ psi} \]
\[ \text{Dynamic Psi = MAASP - CLFP} \]
\[ \text{Dynamic Psi = 1460 – 200 = 1260 psi} \]
\[ \text{Dynamic Psi – Choke Line Psi – Overbalance = Margin psi} \]
\[ 1260 – 600 – 100 = \text{560 psi} \]
\[ \text{Choke Line Psi = SICP – CLFP} \]
\[ \text{Choke Line Psi = 800 – 200 = 600 psi} \]
84. On a semi-submersible a kick is taken while drilling and the following data has been collected.

Well depth (RKB) 16,557 feet MD/14,340 feet TVD
Casing shoe (RKB) 14,870 feet MD/12,855 feet TVD
Formation fracture gradient .845 psi/ft
Mud weight 14.9 ppg
Water depth 930 feet
Water gradient .445 psi/ft
Pressure loss through riser 410 psi
Pressure loss through choke line 655 psi
SIDPP 420 psi
SICP 575 psi

Calculate the margin between the initial dynamic MAASP and the initial choke pressure at the start of the kill operation. Assume a circulating rate of 25 spm.

\[ \text{\textbf{293 – 327 psi}} \]

*Equation \#12 - MAASP = (Frac Grad – Mud Grad) x Csg shoe TVD ft (.845-.7748) x 12,855 = 902
MAASP – SICP = Initial Choke Psi
902 – 575 = 327 psi*

85. Use the following data to determine the shut in kill line pressure.

MW in drill string, annulus and choke line = 10.8 ppg
Choke line length = 1800 feet
Well depth = 8000 feet TD/RKB
Gradient of seawater in kill line = .445 psi/ft

A. 700 psi
B. 500 psi
C. 910 psi (Correct Answer)
D. 950 psi

\[ \text{CLFP} = (\text{MW ppg} - \text{SW ppg}) \times .052 \times \text{kill line ft} \]
\[ \text{CLFP} = (10.8 - 8.55) \times .052 \times 1800 \text{ ft} = 210 \text{ psi} \]

Casing Pressure + CLFP = Kill Line Pressure
700 psi + 210 psi = 910 psi kill line psi
86. The driller needs to close in a flowing well with the drill pipe in a subsea BOP stack. He pushes the “Annular Close” button and the pilot light changes but all gauges and the flow meter remain static. What is his best option?

A. **Change pods and try again (Correct Answer)**
B. Call and wait for a subsea engineer
C. Send the assistant driller to manually operate the 4-way valve on the hydraulic control manifold to close the annular

87. While drilling an alarm goes off indicating low accumulator pressures and the flow meter indicates a rapid loss of fluid. The best course of action to take is.....

A. Stop drilling and shut in the well
B. Stop drilling and call the subsea engineer
C. **Stop drilling and put all functions in block (Correct Answer)**

88. When a function is operated in a piloted hydraulic system which of the following is TRUE?

A. SPM valves will operate in both pods
B. **SPM valves will only operate in the active pod (Correct Answer)**

89. According to API specifications, closing units for subsea installations should be able to close ram preventers within ____45____ seconds and the annular preventer closure time should not exceed ____60____ seconds.

90. On a subsea pod, regulators are used to reduce the main hydraulic fluid supply from 3000 to a lower pressure for use. One of these regulates fluid pressure to the annular preventer. The other is the manifold regulator. Name two items on the stack that are supplied by fluid from the manifold regulator.

______________________________

**RAMS**

______________________________

**CONNECTORS**

91. In order to verify the actual pressure supplied to control either an annular or ram preventer, a read back signal is sent to the surface. It is sent from......

A. Upstream from the regulator in the pod
B. The regulator itself
C. **Downstream of the regulator in the pod (Correct Answer)**