

UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATIONS, DEC 2014

COURSE NO: PE 373

COURSE NAME: **Drilling Engineering**

CLASS: PE III

TIME: 3 HOURS

Name: _____ Index Number: _____

ANSWER ALL THE QUESTIONS

SECTION A

(15 marks)

Read the following questions carefully and provide the correct answer to each of them. Note that for every wrong answer half a mark is deducted so do not guess

Questions	True or False
1. Drilling break is a primary indicator of a kick.	
2. An increase in both the volume and size of cuttings at the shaker is an indication of over-pressured formations.	
3. Swabbing creates a region of low pressure below the bit.	
4. If mud weight is reduced the overbalance becomes less and the risk of taking a kick is reduced.	
5. The desander, as well as the desilter, needs to be downstream of the degasser operation.	
6. Gas separators or busters handle much smaller gas volumes than do degassers.	
7. The purpose of a degasser is to remove gas mixed with the drilling fluid before the drilling fluid goes over the shale shaker.	
8. Desilter cones differ from desander cones only in dimensions and operate on exactly the same principles.	
9. Semi-submersibles are used to drill in deep and remote waters while drillship is used to drill in waters too rough.	
10. In cost per foot analysis, when the drilling time-per-foot begins to increase, and the footage drilled-per-time decreases, the cost-per-foot will begin to decrease.	
11. Along Hole Depth (AHD) is always greater than True Vertical Depth (TVD) in a deviated well.	
12. If a kick is gas rather than brine, then pressure at the shoe will decrease as it is being circulated into the casing shoe.	
13. A heave compensator is a kind of motion compensator that compensate for movement in all directions.	
14. The posted barge type submersible is use to drill in depth bottle type submersible could not be used.	
15. As compaction increases with depth, water is expelled and so conductivity is increased.	

SECTION B**(30 marks)**

Choose the correct letter, A, B, C or D for questions 1 - 30

1. Which of the following directional drilling applications is the most economical way to develop an oil field that is below a large body of water but within drilling reach of land?
 - A. Offshore multiwell drilling
 - B. Offshore drilling to onshore locations
 - C. Onshore drilling to offshore locations
 - D. Multiple exploration wells from a single offshore wellbore

2. Which of the following is NOT a component of the hoisting equipment for a drilling rig?
 - A. Crown block
 - B. Drawworks
 - C. Drilling line
 - D. Rotary table

3. A well kicks. The true vertical depth of the kicking formation is 9,500-ft. The mud gradient in use is 0.5 psi/ft. The well kicks and after closing the BOP, the drill pipe pressure stabilizes at 340 psi. What is the kill mud gradient to balance it?
 - A. 0.5 psi/ft
 - B. 0.54 psi/ft
 - C. 0.55 psi/ft
 - D. 0.56 psi/ft

4.is an area that consists of one or more reservoirs all related to the same structural feature.
 - A. Field
 - B. Pool
 - C. Reservoir
 - D. Fault

5. Mobile floating Platforms includes the following types
 - A. Anchored or dynamically-positioned submersible
 - B. Drill ships and Semi submersibles
 - C. Anchored submersible and Jack up
 - D. Swamp barge and Drillship

6. Which of the following is the most important aspect of controlled directional drilling?
 - A. It enables producers all over the world to develop subsurface deposits that could never be reached economically in any other manner.
 - B. It is the science of deviating a wellbore along a planned course to a surface target location that is a given lateral distance and direction from the horizontal.
 - C. It enables producers all over the world to develop subsurface deposits that could have been lost due to improper drilling equipment.
 - D. It enables producers all over the world to kill wild wells.

7. Which of the following is NOT a primary function of drilling fluids?
- Cuttings removal
 - Frac proppant
 - Lubrication and cooling
 - Well control
8. Mud cleaner:
- A mud cleaner is designed to remove drill solids smaller than barite.
 - It consists of a desilter and a screen.
 - It removes solids in one stage.
- I only
 - II only
 - I & II only
 - I, II & III
9. Appraisal wells are drilled for which of the following reasons?
- To determine the extent of a field
 - To probe the earth where no known hydrocarbons exist
 - To produce an existing field
 - To determine how much area a field covers
10. A formation is to be hydraulically fractured at the depth of 10,000 ft. The fracturing fluid has a specific gravity of 0.85. If the formation breaks down at 80% of the theoretical overburden pressure, what pump pressure will be required for the breakdown?
- 4320
 - 3681
 - 7558
 - 442
11. An increase in penetration rate of a drilling break can be caused:
- By an increase in formation porosity.
 - By an increase in permeability.
 - By an increase in formation pressure.
 - By a change in one OR all the above.
12. Day rate drilling contract:
- The operator prepares a detailed well design and program of work for the drilling operation.
 - The drilling contractor provides the drilling rig and personnel to drill the well.
 - All consumable items (e.g. drilling bits, cement), transport and support services are provided by the drilling contract.
- I only
 - II only
 - I & II only
 - I, II & III
13. What happens to pressure at the shoe as brine kick is being moved into the casing shoe?
- Pressure at the shoe will be constant
 - Pressure at the shoe will reduce
 - Pressure at the shoe will increase
 - None of the above

14. Which following provides a working space for BOP stack?
- A. Cellar and Substructure
 - B. Rathole and Moushole
 - C. Substructure and Rathole
 - D. Cellar and Mousehole
15. Which of the following methods is MOST likely to hydrostatically balance a well kick with only one circulation?
- A. Concurrent
 - B. Driller's
 - C. Tool pusher's
 - D. Wait and weight
16. A well is to be drilled to 10,600 ft and has an expected bottom-hole pressure (P_{bh}) equivalent to 10.5 ppg. What pressure rating should the preventers be? Assume a gas density of 2.5 ppg.
- A. 5,787 psi
 - B. 1,378 psi
 - C. 4,409 psi
 - D. 5,780 psi
17. Mud Check Region:
- I. This region is commonly known as the suction pit.
 - II. The mud sample is taken for testing in this region.
 - III. The mud in this region has already been processed by solids control equipment.
- A. I only
 - B. II only
 - C. I & II only
 - D. I, II & III
18. Which of the following information is essential fracture gradient after a leak off test results have been recorded?
- A. The pore pore pressure of the formation being tested.
 - B. The presence of float subin the drill string.
 - C. The true vertical depth of the casing shoe
 - D. The capacity of the drill string.
19. Which of the following rig is also called self –elevating?
- A. Submersible
 - B. Jackup
 - C. Semi submersibles
 - D. Drillship
20. well trajectory is often used by reservoir engineers and production technologist in exploration and production well.
- A. Build and Hold
 - B. S - Type
 - C. Deep Kickoff and Build
 - D. Deep Kickoff and Hold

21. What is the name commonly given to the Oil Company representative who is present while drilling is taking place?
- The Head Well Digger
 - The Tool Pusher
 - The Offshore Installation Manager
 - The Company Man
22. A penetration rate of 23-ft/hr was observed while drilling in shale at a depth of 9,515-ft using a 9.875-in. bit in the U.S. gulf coast area. The weight on the bit was 25,500-lbf and the rotary speed was 113-rev/min. The equivalent circulating density at the bit was 9.5-lbm/gal. Compute the d-exponent.
- 1.54 d-unit
 - 1.45 d-unit
 - 1.64 d-unit
 - 1.74 d-unit
23. If the circulating pressure losses in the annulus of the above well are 350 psi when drilling at 7500ft with 9.8 ppg mud, what would be the ECD of the mud at 8000 ft.
- 9.81 ppg
 - 10.64 ppg
 - 10.27 ppg
 - 10.72 ppg
24. Swab:
- It is a pressure increase that occurs when tubular goods are pulled out of a liquid filled borehole.
 - It can lead to formation fluid invading the wellbore annulus.
 - It can lead to loss of mud either suddenly by fracturing the formation.
- I only
 - II only
 - I & II only
 - I, II & III
25. Build and Hold Well Profile:
- It has shallow kick-off point (KOP).
 - It is used for deep wells with large horizontal displacements.
 - It is used for moderately deep wells with moderate horizontal displacement, where intermediate casing is not required.
- I only
 - II only
 - I & II only
 - I, II & III
26. Sand Trap:
- It has no agitation and allows particles an opportunity to settle and remain until the trap is periodically cleaned.
 - It is often built with sloping sides to allow particles to settle onto a solid surface and slide to the bottom.
 - It prevents extraneous large cuttings (from any source) from moving downstream and plugging hydrocyclones and degasser.

- A. I only
- B. II only
- C. I & II only
- D. I, II & III

27. Desander:

- I. Desander operation is typically recommended only for unweighted drilling fluids.
- II. Desander operation is typically recommended only for weighted drilling fluids
- III. Desander needs to be downstream of the degasser operation.

- A. I & II only
- B. I & III only
- C. II & III only
- D. I, II & III

28. A kick is being circulated out using the Wait and Weight Kill Method. Shortly after pumping kill mud to the bit, final circulating pressure has suddenly increased by 200 psi. The pump speed has been kept constant at kill speed and there was no change noted on the choke gauge. What is the problem?

- A. The choke has plugged
- B. A bit nozzle has plugged
- C. A pack-off has occurred around the bit.
- D. None of the above

29. Which of the following mobile drilling units have the BOP above the water line?

- A. Jackup and Submersible
- B. Drill Ship and Jackup
- C. Drillship and Semi-submersible
- D. Submersible and semi-submersible

30. Which of the following is the preferred choice for drilling in remote areas?

- A. Submersible
- B. Semisubmersible
- C. Drillship
- D. Jackup

SECTION C

1. QUESTION 1

15 MARKS

A leakoff test was carried out just below a 13 3/8" casing shoe at 7000 ft. TVD using 9.0 ppg mud. The results of the tests are shown in Table 1. What is the maximum allowable mudweight for the 12 1/4" hole section?

Table 1 Results of Leak off Test (LOT)

Volume Pumped	Surface Pressure (psi)
1	400
1.5	670
2	880
2.5	1100
3	1350
3.5	1600
4	1800
4.5	1900
5	1920

- i. Draw a leak-off graph? **4 marks**
- ii. On the graph locate the leak-off point and the fracture point? **2 marks**
- iii. What is the leak-off pressure? **1 mark**
- iv. Calculate:-
 - The maximum pressure that the exposed formations below the shoe can support? **1.5 marks**
 - The fracture gradient? **1.5 marks**
 - The maximum mud weight? **2 marks**
- v. If a mudweight of 9.5ppg is required to drill the 12 1/4" hole section of the above well, what would the MAASP be when drilling this hole section? **3 marks**

QUESTION 2

20 MARKS

- A. Give a schematic diagram for recommended arrangements of the solids control equipment for unweighted and weighted mud systems. **10 marks**
- B. List five major causes of kick **5 marks**
- C. How do pipe rams differ from shear rams? **2 marks**
- D. Define Lost Circulation and state three (3) ways of minimizing lost circulation. **3 marks**

QUESTION 3

20 MARKS

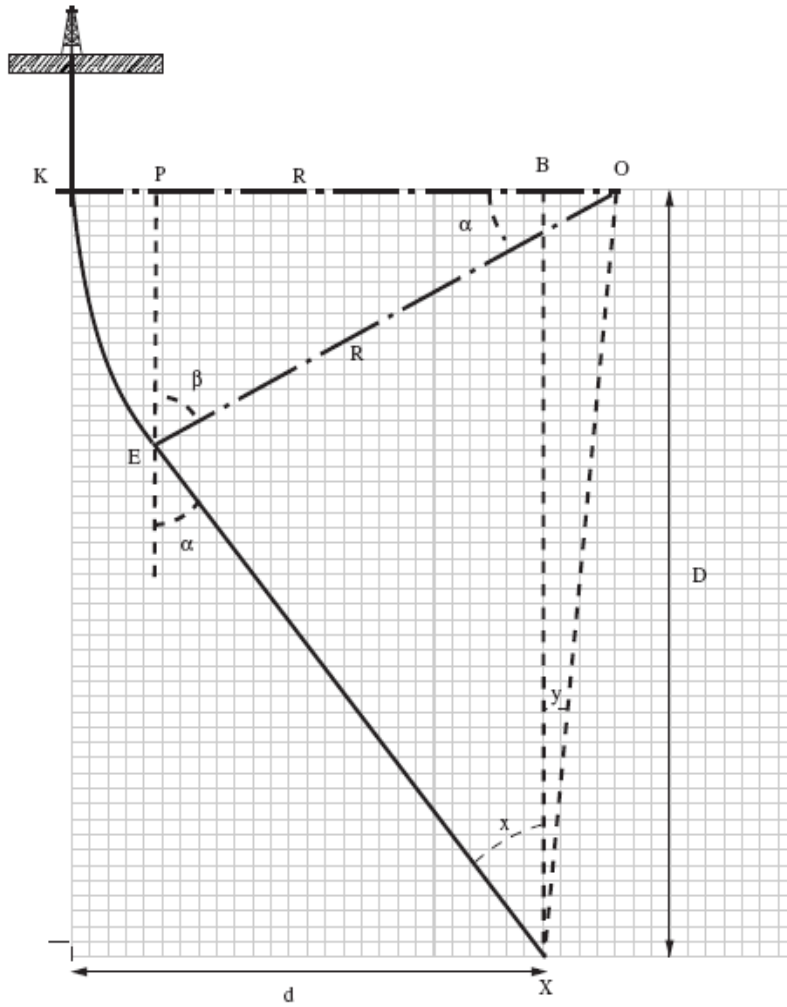
- A. Explain the following terms using a diagram:
 - i. Sidetracking **2.5 marks**
 - ii. Relief well **2.5 marks**
- B. An operating company plans to drill a directional well at the jubilee field in Ghana The sidetrack will be a build and hold profile with the following specifications:
Kick off Point (KOP): 1500ft
Target Depth: 10000 ft.
Horizontal Departure: 3500 ft.

Build up Rate: 1.5° per 100 ft.

Calculate the following:

- The drift angle of the well.
- The Along Hole Depth (AHD) to the target.

9 marks
6 marks



ERIC BRONI-BEDIAKO