

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MINING ENGINEERING

2020 SECOND SEMESTER EXAMINATION

Fourth Year Mining and Mineral Processing Engineering

**MN432 – INTRODUCTION TO PETROLEUM**

**ENGINEERING**

DATE: FRIDAY 23<sup>rd</sup> OCTOBER, 2020

TIME: 8:30 AM

TIME ALLOWED: 3 HOURS

**INFORMATION FOR CANDIDATES:**

1. You have ten minutes to read this question paper. You **SHOULD NOT** begin writing during this period.
2. There are **FIFTY TWO** questions altogether. Answer **FIFTY ONE** questions. All questions carry different marks.
3. **ALL** answers must be written on the answer book provided. No other written material will be accepted.
- 4 Write your **NAME** and **NUMBER** clearly on the **ANSWER BOOK**. Do this **NOW**.

## SECTION A MULTIPLE CHOICE (40 MARKS)

1. The specific gravity of anthracite will be about
  - (a) 1.7
  - (b) 5.0
  - (c) 19
  - (d) 1.0
  - (e) None of the above
  
2. With increasing compaction of coal, the color changes from light brown to :
  - (a) grey
  - (b) black
  - (c) brown
  - (d) light orange
  - (e) None of the above
  
3. Intergranular porosity is normally referred to as:
  - (a) secondary
  - (b) primary
  - (c) tertiary
  - (d) both (a) and (b)
  - (e) None of the above
  
4. Which carbaceous material and petroleum gas  $\delta^{13}\text{C}$  between -10 and -35‰
  - (a) biogenic methane
  - (b) coal
  - (c) natural gas
  - (d) limestone
  - (e) crude oil
  
5. Which regions/countries has the worlds largest hydrocarbon basins by ultimate potential:
  - (a) Kuwait and Iran
  - (b) United Arab Emirates & Qatar
  - (c) Kuwait and United Arab Emirates
  - (d) Serbia and West Serbia
  - (e) None of the above

6. The fuel value of coal increases with increasing
- (a) carbon content
  - (b) structural rearrangement
  - (c) devolatilization
  - (d) water content
  - (e) None of the above
7. Which type of traps accounts for most hydrocarbon accumulation in the world:
- (a) Pinchout
  - (b) reef
  - (c) structural
  - (d) combination
  - (e) None of the above
8. Which depth to primary producing reservoirs accounts for most oilfields of the world?
- (a) intermediate
  - (b) shallow
  - (c) deep >3km
  - (d) both (b) and (c)
  - (e) None of the above
9. Which of the following rock type is a suitable cap rock in petroleum accumulation?
- (a) sandstone
  - (b) mudstone
  - (c) limestone
  - (d) arenite
  - (e) None of the above
10. Above what temperature has organic matter effectively matured to graphite?
- (a) 120°C
  - (b) 60°C
  - (c) 225°C
  - (d) 20°C
  - (e) None of the above

11. The coal becomes sub-bituminous when C reached:
- (a) 10%
  - (b) 60%
  - (c) 95%
  - (d) 90%
  - (e) 85%
12. Bituminization process begins at what temperature:
- (a) 50°C
  - (b) 80°C
  - (c) 15°C
  - (d) 100°C
  - (e) 60°C
13. Which of the following is a mineral matter in coal that is lost on combustion?
- (a) SO<sub>2</sub> and CO<sub>2</sub>
  - (b) H<sub>2</sub>O and salt
  - (c) Carbonates and sulphides
  - (d) All of the above
  - (e) Only (a) and (c)
14. Porosity of the most recent sand deposit is about:
- (a) 0 to 3%
  - (b) 40 to 50%
  - (c) 10 to 20%
  - (d) Less than 1%
  - (e) None of the above
15. Which of the following is a radioactive particle?
- (a) Uranium
  - (b) Thorium
  - (c) Potassium
  - (d) All of the above
  - (e) Only (A) and (B)
16. One thing that is common in water, oil and gases?
- (a) hydrogen
  - (b) carbon
  - (c) oxygen
  - (d) sulfur
  - (e) None of the above

17. Which of the following rock is more radioactive?
- (a) gneiss
  - (b) siltstone
  - (c) sandstone
  - (d) shale
  - (e) None of the above
18. Water has an API gravity of about
- (a) 1
  - (b) 10
  - (c) 20
  - (d) 30
  - (e) None of the above
19. Reflectance of coal is dependent on level of
- (a) moisture content
  - (b) gas content
  - (c) coalification
  - (d) stratification
  - (e) none of the above
20. Network of micro fractures coal develop when subjected to change in stress or uplifting is called;
- (a) shear
  - (b) joints
  - (c) parting
  - (d) cleat
  - (e) None of the above
21. The coal strength varies with
- (a) rank and type
  - (b) age and stratification
  - (c) sedimentary basin
  - (d) degree of metamorphism
  - (e) All of the above

22. Which of the following is a well simulation technique
- (a) Acidizing
  - (b) Hydraulic fracturing
  - (c) Explosive fracturing
  - (d) All of the above
  - (e) Only (a) and (b)
23. Coalification is a
- (a) Geochemical process
  - (b) Biochemical process
  - (c) Photochemical process
  - (d) Igneous process
  - (e) None of the above
24. The compaction ratio of peat to coal conversion is approximately
- (a) 9:1
  - (b) 4:1
  - (c) 3:1
  - (d) 5:1
  - (e) 10:1
25. Paludification is to make a
- (a) soil
  - (b) lake
  - (c) sedimentary basin
  - (d) steam
  - (e) None of the above
26. Coal seam gas is dominated by:
- (a) Methane
  - (b) Water
  - (c) Carbon mono-oxide
  - (d) Carbon dioxide
  - (e) None of the above
27. Natural gases have carbon number from;
- (a) C1 to C7
  - (b) C1 to C3
  - (c) C1 to C4
  - (d) C1 to C5
  - (e) All of the above

28. Primary migration is also called:
- (a) expansion
  - (b) diffusion
  - (c) seep
  - (d) expulsion
  - (e) None of the above
29. What is the longest distance recorded for secondary migration of oil?
- (a) 10 km
  - (b) 100 km
  - (c) 1000km
  - (d) 2000km
  - (e) None of the above
30. The most common reservoir rocks are:
- (a) sandstone and shale
  - (b) Carbonates and greywacke
  - (c) Sandstone and siltstone
  - (d) Sandstone and carbonates
  - (e) All of the above
31. The most dominant basinal setting for giant oil fields are:
- (a) Continental rifts
  - (b) Passive margins
  - (c) Arc continental collision margins
  - (d) Strike slip margins
  - (e) None of the above
32. Which rock type is the most dominant source rock?
- (a) coal
  - (b) marl
  - (c) sandstone
  - (d) shale
  - (e) None of the above

33. Cyclohexane has how many carbons in its structure
- (a) 5
  - (b) 4
  - (c) 6
  - (d) 7
  - (e) None of the above
34. What is the function of drilling fluid
- (a) Remove cutting
  - (b) Lubricate drill bits
  - (c) Maintain pressure in the hole
  - (d) All of the above
  - (e) Only (a) and (b)
35. Air drilling operation in petroleum is used when
- (a) Pipe is stuck and cannot be removed
  - (b) Drilling into a dry, hard, low pressure formation
  - (c) Directional drilling is used
  - (d) Excessive drilling fluid is lost into the formation
  - (e) None of the above
36. The amount of gas measured at the surface divided by the amount of oil measured at the surface is called;
- (a) Gas oil ratio
  - (b) Shrinkage volume
  - (c) Gas compressibility factor
  - (d) Hydrocarbon pore volume
37. Fluid inclusion studies can help you to understand the:
- (a) temperature history
  - (b) Salinity
  - (c) Metal content
  - (d) Behavior of water
  - (e) Only (a) and (b)
38. Which one of the following is a downhole problem if deviations are controlled?
- (a) Dogs leg
  - (b) Key seats
  - (c) Ledge
  - (d) All of the above
  - (e) Only (a) and (c)



39. The ash yield of commercial coal ranges from:
- (a) 3 to 9% ash
  - (b) 10 to 15% ash
  - (c) 16 to 20% ash
  - (d) Less than 3% ash
  - (e) None of the above
40. What are the common minerals in a sandstone reservoir rock?
- (a) Goethite, ilmenite and quartz
  - (b) Calcite, quartz and clay cement
  - (c) Quartz, mica and sericite
  - (d) Quartz, ilmenite and mica
  - (e) None of the above

**SECTION B: SHORT ANSWER QUESTIONS. ANSWER ALL QUESTIONS FOR 40 MARKS.**

41. List the four main geophysical survey methods used in petroleum exploration? (4 marks)
42. What are the four types of artificial lifting used in improving production of hydrocarbon in a well? (4 marks)
43. What are the 6 prerequisites for petroleum accumulations? (6 marks)
44. List any four chemical palaeo-thermometers used in measuring kerogen's maturity? (4 marks)
45. List four theories of primary migration. (4 marks)
46. What are the two essential prerequisites for a good reservoir rock? (2 marks)
47. List the straight chain paraffins with Carbon number 1 to carbon number 8. (8 marks)
48. What are the three types of tubular products used in well completion? (3 marks)
49. List five wireline logging tools used in petroleum industry. (5 marks)

**SECTION C: LONG ANSWER QUESTIONS. Answer ONLY 2 out of the 3 questions for a total of 20 marks.**

50. List 6 types of structural trap and draw simple figures to illustrate each type.

**(10 marks)**

51. (a) An oil reservoir has a bulk volume of 22,000 acre-feet, an average porosity of 23%, a connate water saturation of 32% and an oil formation volume factor of 1.215 RVB/STB. Calculate STOOIP.?

(b) For the problem above, calculate the solution gas in place assuming a solution gas oil ratio of 1000 SCF/STB. Then convert it to metric units, multiply by 0.028317 M<sup>3</sup>/ft<sup>3</sup>

**(10 marks)**

52. Classify the coal in terms of rank from low calorific value to high calorific value and indicate carbon and water content for each rank and indicate its end use.

**(10 marks)**