
UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session of 2006/2007
*Peperiksaan Semester kedua
Sidang Akademik 2006/2007*

April 2007
April 2007

EBS 418E/3 – PETROLEUM ENGINEERING *KEJURUTERAAN PETROLEUM*

Time: 3 hours
Masa: 3 jam

Instruction to Candidates

Before you begin with the examination, please make sure that this paper contains 20 pages of printed pages and 3 pages of appendices.

This examination paper is made up of two sections:

- | | |
|--------------------------------|---|
| Question number 1 | 60 objective questions (answer all questions on the objective answer sheet as provided in the Appendix 3). Detach the answer sheet to be handed in along with other answer scripts. |
| Questions number 2, 3, 4 and 5 | 4 subjective questions and answer any 2 (two) of them. |

The answer for each number of subjective type question must begin on a fresh page and answer the questions in English Language but you are allowed to answer one question in Malaysian Language.

Arahan kepada calon

Sebelum anda mulakan peperiksaan, sila pastikan kertas ini mengandungi 20 helai kertas bercetak dan 3 helai lampiran.

Kertas peperiksaan ini terdiri daripada dua bahagian:

- | | |
|------------------------------------|---|
| <i>Soalan nombor 1</i> | <i>60 soalan objektif (jawab semua soalan di atas kertas jawapan objektif yang disediakan di Lampiran 3. Ceraikan kertas jawapan ini untuk dikemukakan bersama dengan kertas jawapan yang lain.</i> |
| <i>Soalan nombor 2, 3, 4 dan 5</i> | <i>4 soalan subjektif dan jawab mana-mana 2 (dua) soalan.</i> |

Jawapan bagi setiap soalan subjektif hendaklah dimulakan di muka surat yang baru dan jawab semua soalan dalam Bahasa Inggeris tetapi anda dibenarkan menjawab satu soalan dalam Bahasa Malaysia.

Attempt all questions in Question 1 (on the answer sheet in Appendix 3)
and any other two subjective questions.

*Jawab semua soalan dalam Soalan 1 (di atas kertas jawapan di Lampiran 3)
dan mana-mana dua soalan subjektif yang lain.*

- | | |
|--|--|
| <p>1. 1.1 To function as a reservoir rock, a rock must have</p> <p>A. a pool of oil in it.
B. a pool of gas and oil in it.
C. some open space within its structure to contain oil and gas.
D. correct type of rock to act as reservoir rock.</p> | <p>1.1 Untuk berperanan sebagai batuan reservoir, suatu batuan itu hendaklah mempunyai</p> <p>A. sebuah kolam minyak di dalamnya.
B. sebuah kolam gas dan minyak di dalamnya.
C. ruang terbuka di dalam strukturnya yang membolehkannya mengandungi minyak dan gas.
D. jenis batuan yang betul sebagai batuan reservoir.</p> |
| <p>1.2 What is porosity in rock?</p> <p>A. It is as a percent of water content in rock.
B. It is a percent of open space of rock to the overall rock volume.
C. It is a percent of pore space of rock to the volume of oil.
D. It is a percent of oil space to the overall volume of rock.</p> | <p>1.2 Apakah keliangan dalam batuan?</p> <p>A. Ia adalah peratusan air yang terdapat di dalam batuan.
B. Ia adalah peratusan ruangan terbuka di dalam batuan kepada isipadu batuan keseluruhan.
C. Ia adalah peratusan ruang liang batuan kepada isipadu minyak.
D. Ia adalah peratusan ruangan minyak kepada isipadu keseluruhan batuan.</p> |
| <p>1.3 A reservoir rock's porosity must be for the oil and gas to flow through the formation to the wellbore.</p> <p>A. inter-connected
B. big enough
C. high
D. channel like</p> | <p>1.3 Keliangan batuan reservoir mestilah untuk minyak dan gas mengalir melalui formasi kepada lubang telaga.</p> <p>A. bersambungan
B. cukup besar
C. tinggi
D. berupa terusan</p> |
| <p>1.4 is the flow of fluid of viscosity 1 centipoise through a medium of cross-sectional area of 1 cm² at a flow rate of 1 cm³ per second with a pressure drop of 1 atmosphere per cm.</p> <p>A. 1 darcy
B. 1 millidarcy
C. permeability
D. 1 centipoise</p> | <p>1.4 ialah aliran cecair berkelikatan 1 centipoise yang mengalir melalui suatu medium dengan keratan rentas 1 cm² pada kadar alir 1 cm³ per saat dengan kejatuhan tekanan 1 atmosfera per cm.</p> <p>A. 1 darcy
B. 1 mili darcy
C. Kebolehtelapan
D. 1 centipoise</p> |

- 1.5 The permeability on inter-granular porosity is highly variable. For example, sandstones recently deposited on continental margins are often loosely consolidated and without cementation. Permeability is therefore
- A. low
B. about 1 m/s
C. high
D. not known
- 1.6 The SCF and STB are referred in standard condition. What is the standard condition?
- A. 60°F, 14.7 psi
B. 80°F, 14.7 psi
C. 60°F, 14.17 psi
D. 60°F, 14.3 psi
- 1.7 Many petroleum reservoirs produced
- A. oil
B. gas
C. water
D. oil, gas and water
- 1.8 Lighter oils contain higher percentages of the more valuable products such as
- A. gas
B. methane
C. gasoline
D. condensate
- 1.9 In an anticlinal oil reservoir, the sandstone is overlain by shale that stops the oil from further vertical migration. The shale formation is usually referred as the
- A. source rock
B. cap rock
C. reservoir rock
D. impermeable rock
- 1.10 What is meant by bubble point pressure?
- A. It is the pressure at which the bubble burst.
B. It is the pressure at which the liquified petroleum gas becomes bubbles.
C. It is the pressure at which the first gas is liberated from the reservoir crude.
- 1.5 *Kebolehtelapan bagi keliangan antara-butiran ialah berbeza-beza. Contohnya, batu pasir yang baru dimendapkan di atas margin kontinental kebiasaannya dalam keadaan longgar dan tanpa penyimenan. Maka kebolehtelapannya adalah*
- A. rendah
B. lebih kurang 1 m/s
C. tinggi
D. tidak diketahui
- 1.6 *SCF dan STB dirujuk dalam keadaan piawai. Apakah keadaan piawai?*
- A. 60°F, 14.7 psi
B. 80°F, 14.7 psi
C. 60°F, 14.17 psi
D. 60°F, 14.3 psi
- 1.7 *Kebanyakan reservoir petroleum mengeluarkan*
- A. minyak
B. gas
C. air
D. minyak, gas dan air
- 1.8 *Minyak yang ringan mengandungi peratusan yang tinggi bagi produk yang lebih berharga seperti*
- A. gas
B. metana
C. gasolin
D. pahuwap
- 1.9 *Dalam reservoir minyak antiklin, batu pasir dilitup oleh syal yang menghalang minyak daripada penghijrahan menegak. Formasi syal ini disebut sebagai*
- A. batuan sumber
B. batuan tutup
C. batuan reservoir
D. batuan tidak telap
- 1.9 *Apakah makna tekanan titik gelembung?*
- A. Ia adalah tekanan di mana gelembung pecah.
B. Ia adalah tekanan di mana gas petroleum cecair menjadi gelembung.
C. Ia adalah tekanan di mana gelembung yang pertama dilepaskan daripada minyak mentah reservoir.

- D. It is the pressure at which the gasoline is produced from the crude oil.
- 1.11 A gas cap is free gas trapped in the top of the structure above the oil. When there is a gas cap, the reservoir is at
- A. the reservoir pressure
B. the bubble point pressure
C. the gas pressure
D. abnormal pressure
- 1.12 The fluids in oil and gas reservoir exist under pressure. When a well is drilled into a reservoir, it creates a conduit to the surface. between the reservoir and the surface then drives reservoir fluids horizontally through the reservoir to the wellbore and then vertically up the hole.
- A. The pressure differential
B. The temperature differential
C. The forces
D. The permeability
- 1.13 Formation volume factor is an important factor to be known in calculating the reserve of an oil field. What is meant by formation volume factor?
- A. It is the crude reservoir volume occupied per volume of stock tank oil.
B. It is the volume of crude oil in reservoir conditions.
C. It is the volume factor of crude oil in reservoir temperature and pressure.
D. It is the volume factor of crude oil and gas in the formation.
- 1.14 The value of formation volume factor is always
- A. >1.0 C. >1.5
B. <1.0 D. <1.5
- 1.15 The density of oil is measured in $^{\circ}\text{API}$ at the temperature of 60°F and at atmospheric pressure. Which of the following relationship is correct?
- A. $X^{\circ}\text{API} = \frac{141.5}{\text{specific gravity}} - 131.5$
- D. Ia adalah tekanan di mana gasolin dikeluarkan daripada minyak mentah.
- 1.11 Tukup gas ialah gas yang terperangkap di bahagian atas struktur di atas minyak. Apabila terdapat tukup gas, reservoir ialah pada
- A. tekanan reservoir
B. tekanan tahap gelembung
C. tekanan gas
D. tekanan tidak biasa
- 1.12 Bendalir dalam reservoir minyak dan gas terdapat di bawah tekanan. Apabila satu telaga digerudi ke dalam sebuah reservoir, ia mewujudkan satu laluan ke permukaan. diantara reservoir dan permukaan memacu bendalir reservoir secara mendatar melalui reservoir kepada telaga dan mengalir menegak ke atas.
- A. Perbezaan tekanan
B. Perbezaan suhu
C. Daya-daya
D. Kebolehtelapan
- 1.13 Faktor isipadu formasi adalah faktor yang penting diketahui dalam pengiraan rizab sesuatu lapangan minyak. Apakah makna faktor isipadu formasi?
- A. Ia adalah isipadu minyak mentah reservoir per isipadu minyak tangki stok.
B. Ia adalah isipadu minyak mentah dalam keadaan reservoir.
C. Ia adalah faktor isipadu minyak mentah dalam suhu dan tekanan reservoir.
D. Ia adalah faktor isipadu bagi minyak mentah dan gas dalam formasi.
- Nilai faktor isipadu formasi kebiasaannya ialah
- A. >1.0 C. >1.5
B. <1.0 D. <1.5
- 1.15 Ketumpatan minyak diukur dalam $^{\circ}\text{API}$ pada suhu 60°F dan tekanan atmosfera. Hubungan yang manakah seperti berikut yang betul?
- A. $X^{\circ}\text{API} = \frac{141.5}{\text{graviti tentu}} - 131.5$

$$B. X^0 \text{ API} = \frac{\text{specific gravity}}{141.5} - 131.5$$

$$C. X^0 \text{ API} = \frac{141.5}{131.5} - \text{specific gravity}$$

$$D. X^0 \text{ API} = \frac{141.5 + \text{specific gravity}}{\text{specific gravity}} - 131.5$$

$$B. X^0 \text{ API} = \frac{\text{graviti tentu}}{141.5} - 131.5$$

$$C. X^0 \text{ API} = \frac{141.5}{131.5} - \text{graviti tentu}$$

$$D. X^0 \text{ API} = \frac{141.5 + \text{graviti tentu}}{\text{graviti tentu}} - 131.5$$

1.16 When the crude oil is referred in the the unit of STB (stock tank barrel), what does it means?

- A. The volume of crude oil in barrel in standard temperature (80° F) and pressure (14.7 psi).
- B. The volume of crude oil in an API standard of tank barrel.
- C. The volume of crude oil in surface temperature and pressure.
- D. The volume of crude oil in barrel in standard temperature (60° F) and pressure (14.7 psi).

1.17 In oil production, the GOR is always monitored for the purpose of obtaining optimum production from any well or any field. What is the unit of GOR?

- A. SCF/STB
- B. MCF/STB
- C. RCF/STB
- D. RCF/bbl

1.18 Liquefied natural gas composed primarily of the light members of the paraffin series and are predominantly

- A. butane
- B. methane
- C. ethane
- D. propane

1.19 Liquefied petroleum gas (LPG) composed primarily of

- A. propane and butane
- B. methane
- C. ethane
- D. propane

1.20 Natural gas is referred in term of gas gravity. What is gas gravity?

- A. It is the density of gas relative to the density of water at standard conditions.

1.16 Apabila minyak mentah dirujuk sebagai unit STB (stock tank barrel), apakah maksudnya?

- A. Isipadu minyak mentah dalam tong dalam suhu (80° F) dan tekanan (14.7 psi) piawai.
- B. Isipadu minyak mentah dalam piawaian API bagi tong tangki.
- C. Isipadu minyak mentah di suhu dan tekanan permukaan.
- D. Isipadu minyak mentah dalam unit tong dalam suhu (60° F) dan tekanan (14.7 psi) piawai.

1.17 Dalam pengeluaran minyak, GOR selalu dipantau untuk tujuan pengeluaran optimum daripada telaga atau mana-mana lapangan. Apakah unit GOR.

- A. SCF/STB
- B. MCF/STB
- C. RCF/STB
- D. RCF/bbl

1.18 Gas asli cecair pada asasnya mengandungi siri parafin ringan dan kebanyakannya ialah.....

- A. butana
- B. metana
- C. etana
- D. propana

1.19 Gas petroleum cecair pada asasnya mengandungi

- A. propana dan butana
- B. metana
- C. etana
- D. propana

1.20 Gas asli dirujuk dalam sebutan graviti gas. Apakah graviti gas?

- A. Ia adalah ketumpatan gas relatif kepada ketumpatan air pada keadaan piawai.

- B. It is the density of gas.
 C. It is the ratio of the density of a gas to the density of air at standard conditions.
 D. It is the density of gas relative to the density of hydrogen.
- 1.21 Recovery factor is
- A. the factor used for economic study of oil reserve.
 B. the factor used to decide on the terms of production sharing contract.
 C. the time at which the investment on drilling can be recovered
 D. the percent of the reservoir's OOIP or OGIP that will be recovered.
- 1.22 In Malaysia, Petronas and its contractors work on the basis of
- A. concession contracts
 B. production sharing contract
 C. service contracts
 D. royalty payments
- 1.23 The elevated pressures encountered with depth are due to one or both of the following causes:
- I. Hydrostatic pressure imposed by the weight of fluid (predominantly water) which fills the voids of the rocks above and contiguous with the reservoir in question.
 II. The high pressure that occurred naturally within the reservoir.
 III. Overburden pressure due to the weight of the rocks and their fluid content existing above the reservoir.
 IV. Bubble pressure above the reservoir.
- A. All of the above
 B. I and III
 C. III and IV
 D. I and II
- 1.24 Most of the drilling done in petroleum industry is by
- A. percussion drilling
 B. auger drilling
 C. cable tool drilling
 D. rotary drilling
- B. Ia adalah ketumpatan gas.
 C. Ia adalah nisbah bagi ketumpatan gas relatif kepada ketumpatan udara pada keadaan piawai.
 D. Ia adalah ketumpatan gas relatif kepada ketumpatan hidrogen.
- 1.21 Faktor perolehan ialah
- A. faktor yang digunakan untuk kajian ekonomi bagi reservoir.
 B. faktor yang digunakan untuk membuat keputusan ke atas syarat-syarat bagi kontrak perkonsian pengeluaran.
 C. Masa di mana pelaburan ke atas penggerudian boleh diperolehi.
 D. Peratusan OOIP reservoir atau OGIP yang boleh diperolehi.
- 1.22 Di Malaysia, Petronas dan kontraktornya bekerja atas dasar
- A. kontrak konsesi
 B. kontrak perkongsian pengeluaran
 C. kontrak perkhidmatan
 D. pembayaran royalti
- 1.23 Tekanan didapati bertambah dengan kedalaman dan ini disebabkan oleh satu atau dua daripada sebab-sebab berikut:
- I. Tekanan hidrostatik disebabkan oleh berat bendalir (kebanyakannya air) yang memenuhi liang-liang batuan di atas dan berterusan dengan reservoir berkenaan.
 II. Tekanan tinggi yang terdapat secara semulajadi di dalam reservoir.
 III. Tekanan beban atas disebabkan oleh berat batuan dan kandungan bendalir yang terdapat di atas reservoir.
 IV. Tekanan gelembung di atas reservoir.
- A. Semua di atas
 B. I dan III
 C. III dan IV
 D. I dan II.
- 1.24 Kebanyakan penggerudian dalam industri petroleum dilakukan oleh
- A. penggerudian hentakan
 B. penggerudian auger
 C. penggerudian alat kabel
 D. penggerudian putaran

1.25 The heaviest work on a drilling rig is performed by the as it runs the drill string in and out of the hole.

- E. drill collar
- F. drill pipe
- G. mud pumps
- H. hoisting system

1.26 What is the purpose of the drill collar in the the drilling string?

- A. To stiffen the end of the drill pipes and give the appropriate weight on bit for successful drilling.
- B. Same purpose as the ordinary drill pipe.
- C. To act as casing for the drilled hole.
- D. To produce oil and gas.

1.25 Kerja yang paling berat di atas rig pengerudian dilakukan oleh kerana ia mengendalikan paip gerudi untuk masuk dan keluar daripada lubang.

- A. relang gerudi
- B. paip gerudi
- C. pam lumpur
- D. sistem angkat

1.26 Apakah tujuan relang pengerudian dalam talian gerudi?

- A. Untuk mengerasakan hujung paip gerudi dan memberi berat bersesuaian ke atas bit gerudi untuk kejayaan pengerudian.
- B. Tujuan yang sama seperti paip gerudi yang biasa.
- C. Untuk bertindak sebagai selongsong kepada lubang yang digerudi.
- D. Untuk mengeluarkan minyak dan gas.

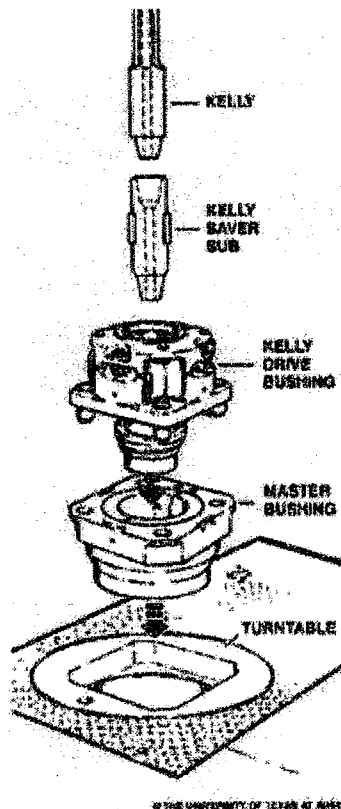


Figure 1
Rajah 1

The following are the answers for questions 1.27 to 1.30 based on Figure 1, but not necessarily based on the label.

- A. Kelly
- B. Kelly bushing
- C. Rotary table
- D. Kelly saver sub

Berikut adalah jawapan kepada soalan-soalan 1.27 hingga 1.30 berdasarkan kepada Rajah 1, tetapi tidak semestinya berdasarkan kepada label.

- A. Kelly
- B. Kelly bushing
- C. Rotary table
- D. Kelly saver sub

- 1.27 A revolving or spinning section of the drillfloor that provides power to turn the drillstring.
- 1.28 A long square or hexagonal steel bar with a hole drilled through the middle for a fluid path; goes through the kelly bushing, which is driven by the rotary table.
- 1.29 An adapter that connects the kelly to the rotary table.
- 1.30 A short length of pipe to save the thread of the kelly from being damaged due to many screwing and unscrewing of drill pipes during drilling.
- 1.27 Bahagian lantai gerudi yang berputar bagi memberi kuasa untuk memutar tali gerudi.
- 1.28 Batang keluli yang panjang dan berbentuk empat segi tepat atau heksagon dengan satu lubang di bahagian tengah untuk laluan cecair; melalui kelly bushing, yang dipacu oleh meja berputar.
- 1.29 Suatu adapter yang menghubungkan kelly kepada meja berputar
- 1.30 Satu paip pendek untuk menghindarkan benang skru kelly daripada rosak disebabkan terlalu kerap memutar masuk dan memutar keluar paip gerudi semasa menggerudi.

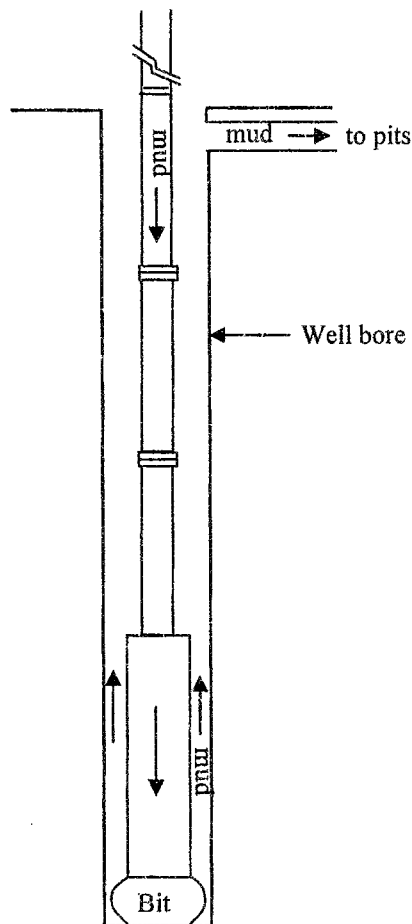


Figure 2
Rajah 2

The following are the answers for questions 1.31 to 1.34 based on Figure 2.

- A. tool joints
- B. drill collars
- C. drill pipe
- D. drilling mud

Berikut adalah jawapan bagi soalan-soalan 1.31 hingga 1.34 berdasarkan kepada Rajah 2.

- A. sambungan peralatan
- B. relang gerudi
- C. paip gerudi
- D. lumpur penggerudian

- 1.31 Several joints of thick pipes to provide the BHA with stiffened section near the drill bit and provide weight on bit.
- 1.32 Most of the drilling string is made up of this section.
- 1.33 The joints of the drill pipes.
- 1.34 The fluid used to counter balance the formation pressure in order to prevent blow out while drilling.
- 1.35 In a drilling rig, is the traveling pulley assembly that connects the drilling line to the hook and swivel. The swivel must suspend the drill string and allow rotation at the same time.
- A. the crown block
B. the swivel block
C. the traveling block
D. draw works
- 1.36 A normal temperature gradient of the earth seems to be about
- A. $1.6^{\circ}\text{F}/100\text{ ft}$
B. $-1.6^{\circ}\text{F}/100\text{ ft}$
C. $2.0^{\circ}\text{F}/100\text{ ft}$
D. $-2.0^{\circ}\text{F}/100\text{ ft}$
- 1.37 The mud pump used in drilling for oil and gas is the
- A. centrifugal pump
B. sucker rod pump
C. reciprocating pump
D. air pump
- 1.38 The main function of a is to furnish a means of closing off the annular space between the drill pipe and casing when the well begins to kick.
- A. blow out preventer
B. christmas tree
C. emergency valve
D. choke
- 1.31 Beberapa sambungan paip tebal untuk memberi BHA dengan bahagian yang keras berhampiran bit gerudi dan memberi berat ke atas bit.
- 1.32 Kebanyakan talian gerudi terdiri daripada bahagian ini.
- 1.33 Sambungan paip gerudi.
- 1.34 Bendalir yang digunakan untuk mengimbangi tekanan formasi supaya seburan liar boleh diatasi
- 1.35 Dalam rig penggerudian, ialah pemasangan takal bergerak yang menghubungkan talian gerudi kepada cangkuk dan swivel. Swivel mesti mengantungkan talian gerudi dan membolehkan putaran berlaku pada masa yang sama.
- A. blok atas
B. blok swivel
C. blok bergerak
D. draw works
- 1.36 Kecerunan suhu biasa bumi didapati lebih kurang
- A. $1.6^{\circ}\text{F}/100\text{ ft}$
B. $-1.6^{\circ}\text{F}/100\text{ ft}$
C. $2.0^{\circ}\text{F}/100\text{ ft}$
D. $-2.0^{\circ}\text{F}/100\text{ ft}$
- 1.37 Pam lumpur yang digunakan dalam penggerudian minyak dan gas ialah
- A. pam empar
B. pam rod penghisap
C. pam salingan
D. pam udara
- 1.38 Fungsi utamaialah untuk membolehkan ruang annulus di antara paip gerudi dan selongsong ditutup sekiranya telaga mula mengeluarkan gas.
- A. penahan sembur liar
B. pokok krismas
C. injap kecemasan
D. pencekik

- 1.39 What is the main material used in the drilling fluid?
- A. bentonite
B. illite
C. montmorillinite
D. kaolin
- 1.39 Apakah bahan utama digunakan dalam bendalir pengerudian?
- A. bentonit
B. illit
C. montmorilinit
D. kaolin
- 1.40 Why is barite used as the weighing material in drilling mud?
- I. It has a high SG.
II. It is soft and easier to be grounded.
III. It is cheap
IV. It is readily available almost anywhere
- A. All of the above
B. None of the above
C. I and II
D. I, II and III
- 1.40 Kenapakah barit digunakan sebagai bahan pemberat dalam lumpur pengerudian?
- I. Ia mempunyai graviti tentu yang tinggi.
II. Ia lembut dan mudah untuk dikisar.
III. Ia murah.
IV. Ia mudah diperolehi hampir di semua tempat.
- A. Semua di atas
B. Tiada bagi semua di atas
C. I dan II
D. I, II dan III
- 1.41 What is the specific gravity of barite?
- A. 2.7
B. 7.2
C. 5.0
D. 4.2
- 1.41 Apakah graviti tentu barit?
- A. 2.7
B. 7.2
C. 5.0
D. 4.2
- 1.42 The first stage of treating the drilling mud while drilling is the
- A. mud tank
B. shale shaker
C. drill pipe
D. desander
- 1.42 Peringkat pertama lumpur pengerudian di rawat semasa pengerudian ialah
- A. tangki lumpur
B. pengoncang syal
C. paip gerudi
D. pengenyahpasir
- 1.43 A drilling mud is having a mud weight of 12 ppg. What is the specific gravity of the mud?
- A. 1.44
B. 1.44 g/cm³
C. 1,440kg/m³
D. 1.2 g/cm³
- 1.43 Suatu lumpur pengerudian mempunyai berat lumpur 12 ppg. Apakah graviti tentu lumpur?
- A. 1.44
B. 1.44 g/cm³
C. 1,440 kg/m³
D. 1.2 g/cm³
- 1.44 A formation is imposing a pressure of 2,550 psi at a depth of 4,556 feet. What is the weight of the mud required to counter balance the formation pressure while still drilling?
- A. 6.66 ppg
B. 8.76 ppg
C. 9.76 ppg
D. 10.76 ppg
- 1.44 Satu formasi memberi tekanan 2,550 psi pada kedalaman 4,556 kaki. Apakah berat lumpur yang diperlukan untuk mengimbangi tekanan formasi semasa menggerudi?
- A. 6.66 ppg
B. 8.76 ppg
C. 9.76 ppg
D. 10.76 ppg

- 1.45 In most oil drilling operation, what type of mud is being used?
- water based mud
 - oil based mud
 - water
 - air and foam
- 1.46 In case where drilling using water based mud cause the shale to swell and stuck pipe is inherent, is recommended to be used in drilling.
- water based mud
 - water
 - air and foam
 - oil based mud
- 1.47 are used to evaluate possible producing zones encountered in wildcat wells.
- PVT tests
 - Drill stem tests
 - Gas tests
 - Oil tests
- 1.48 Production wells offshore are drilled from platforms of which several wells are drilled from a platform. was developed to drill multiple wells from the same platform, but the wells have dispersed bottom-hole location.
- Special drilling
 - Remote drilling
 - Directional drilling
 - Multiple drilling
- 1.49 The main purpose of primary cementing of the casings are:
- To afford additional support for the casing, either by physical bracing or prevention of formation pressures being imposed on the pipe.
 - To retard corrosion by minimizing contact between the pipe and corrosive formation waters.
 - To enhance the production of crude oil.
 - To control the GOR of the produced crude.
- 1.45 Dalam kebanyakan operasi pengerudian, apakah jenis Lumpur yang digunakan?
- Lumpur berdasarkan air
 - Lumpur berdasarkan minyak
 - air
 - air dan buih
- 1.46 Dalam kes di mana pengerudian menggunakan lumpur berdasarkan kepada air mengakibatkan syal mengembang dan paip melekat tidak dapat dielakkan, disyorkan digunakan dalam pengerudian.
- lumpur berdasarkan air
 - air
 - udara dan buih
 - lumpur berdasarkan minyak.
- 1.47 digunakan untuk membuat penialaian ke atas zon yang boleh memberi pengeluaran yang dijumpai dalam telaga wild cat.
- ujian PVT
 - ujian batang gerudi
 - ujian gas
 - ujian minyak
- 1.48 Telaga-telaga pengeluaran digerudi daripada pelantar-pelantar di mana beberapa telaga digerudi daripada sesebuah pelantar. telah dibentuk untuk menggerudi beberapa telaga daripada platform yang sama, tetapi telaga-telaga ini mempunyai kedudukan bawah lubang yang berbeza.
- Pengerudian istimewa
 - Pengerudian jarak jauh
 - Pengerudian berarah
 - Pengerudian multiple
- 1.47 Tujuan utama penyimenan primer selongsong ialah:
- Untuk memberi sokongan tambahan kepada selongsong, sama ada melalui sangkutan secara fizikal atau menghindarkan tekanan formasi dikenakan ke atas paip.
 - Untuk melambatkan kesan kakisan dengan mengurangkan sentuhan di antara paip dan air formasi yang menghakis.
 - Untuk menambahkan pengeluaran minyak mentah
 - Untuk mengawal GOR dalam minyak mentah yang dikeluarkan.

- A. All of the above
 B. I, II and III
 C. I and II
 D. II, III and IV
- 1.50 The casing is cemented to the well bore. The technique used is
- A. by throwing the cement slurry into the annular.
 B. by pumping cement straight into the annular.
 C. by shotcreting the bore hole first, then run in casing.
 D. by pumping the cement through the casing and the casing shoe into the annulus
- 1.51 The pipe grade indicates the pipe's and certain special characteristics.
- A. compressive strength
 B. tensile strength
 C. yield strength
 D. burst strength
- 1.52 Pipe N-80 has a minimum
- A. yield strength of 80,000 psi.
 B. compressive strength of 80,000 psi
 C. tensile strength of 80,000 psi
 D. burst strength of 80,000 psi
- 1.53 Evaluation of the drilling fluid is known as
- A. mud logging
 B. mud analyse
 C. drilling fluid observation
 D. drilling fluid evaluation
- 1.54 This method of logging is important in determining the water content and oil content within the formation.
- A. Resistivity method
 B. SP method
 C. Temperature logging
 D. Borehole caliper
- 1.55 How to open a passage way for the flow of oil from the formation to the well, after the well has been completed with cemented casing?
- A. Semua di atas
 B. I, II dan III
 C. I dan II
 D. II, III dan IV
- 1.50 *Selongsong disimen kepada dinding telaga. Teknik yang digunakan ialah*
- A. dengan membuang buburan simen ke dalam ruang anulus.
 B. dengan mengepam simen terus ke dalam ruang anulus.
 C. dengan syotkrit dinding lubang terlebih dahulu, kemudian selongsong dimasukkan.
 D. dengan mengepam simen melalui selongsong dan kaki selongsong ke dalam anulus.
- 1.51 *Gred paip menunjukkan dan beberapa sifat istimewa.*
- A. kekuatan mampatan
 B. kekuatan tegangan
 C. kekuatan alahan
 D. kekuatan pecah
- 1.52 *Paip N-80 mempunyai minimum.*
- A. kekuatan alahan 80,000 psi
 B. kekuatan mampatan 80,000 psi
 C. kekuatan tegangan 80,000 psi
 D. kekuatan pecah 80,000 psi
- 1.53 *Penilaian bendalir pengerudian dikenali sebagai*
- A. pengelog lumpur
 B. analisa lumpur
 C. pemerhatian bendalir pengerudian
 D. penilaian bendalir pengerudian
- 1.54 *Kaedah pengelogan ini adalah penting dalam menentukan kandungan air dan kandungan minyak di dalam formasi.*
- A. kaedah-kerintangn
 B. kaedah SP
 C. pengelog suhu
 D. angkup lubang gerudi
- 1.55 *Bagaimanakah membuka laluan minyak supaya mengalir daripada formasi ke dalam telaga, setelah telaga dilengkapkan dengan selongsong yang sudah disimenkan?*

- A. At the bottom of the casing there is a valve which is already in place. The opening of this valve will let the oil to flow into the well.
- B. The production tubing and packer is lowered and installed near the formation.
- C. The passage is always open because at the formation, there is no casing and cement.
- D. The casing is perforated with shaped charges in areas where the formation is located.

1.56 To achieve an effective cement job (in cementing the casing to the well bore), the cement slurry must bond to the formation. What tool is used to scrap and scratch the mud cake on the formation to promote bonding to the virgin formation.

- A. cement baskets
- B. cement cleaner
- C. scratchers
- D. packers

- A. Di bahagian bawah selongsong terdapat satu injap yang tersedia. Injap ini dibuka untuk membolehkan minyak mengalir ke dalam telaga.
- B. Tiub pengeluaran dan penyendat diturunkan dan dipasangkan berhampiran dengan formasi.
- C. Laluan sentiasa terbuka kerana di formasi, tiada terdapat selongsong dan simen.
- D. Selongsong ditebuk dengan menggunakan 'shaped charges' di kawasan yang terdapat formasi.

1.56 Untuk memperolehi kerja penyimenan yang berkesan (dalam penyimenan selongsong kepada lubang telaga), buburan simen mestilah melekat kepada formasi. Apakah alat yang digunakan untuk mengosok dan mencakar kepingan lumpur di formasi untuk memberi perlekatan yang baik kepada formasi baru digerudi.

- A. bakul simen
- B. pembersih simen
- C. pencakar
- D. penyendat

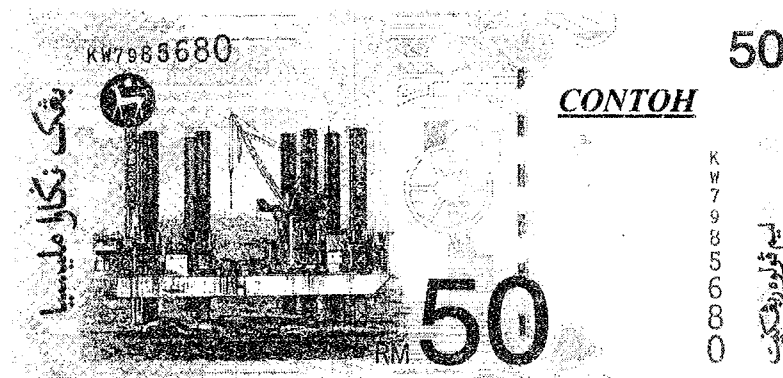


Figure 3
Rajah 3

1.57 What type of drilling rig that appears at the back of the RM50 bill (Figure3)?

- A. Semi-submersible
- B. Drilling ship
- C. Jack up rig
- D. Tender assisted rig

1.57 Apakah jenis rig penggerudian yang terdapat di belakang wang RM50 (Rajah 3)?

- A. Semi-submersible
- B. Kapal penggerudian
- C. Jack up rig
- D. Tender assisted

1.58 After drilling an oil well, the well is completed with cemented casing, production tubing and (an array of valves and chokes) set in place.

1.58 Setelah mengerudi sebuah telaga minyak, telaga ini dilengkapi dengan selongsong bersimen, tiub pengeluaran dan (susunan injap dan pencekik) dipasang.

- A. christmas tree
B. drilling string
C. piping
D. cathead
- 1.59 The oil will flow from the well and straight to a separator. What is the function of the separator?
- I. To separate natural gas and oil.
II. To separate oil and water.
III. To refine crude oil.
IV. To separate drill cuttings from oil.
- A. All of the above C. I, II and IV
B. I, II and III D. I and II
- 1.60 After a well has been producing for a while, it is often necessary to re-enter and repair it. These works include plugging back to a new zone, deepening to a new zone, repairing casing leaks, replacing faulty well equipment, stimulation work (acidizing or fracturing the formation) and others. This is usually called
- A. well workover
B. completion
C. perforation
D. running in hole
- A. pokok krismas
B. talian pengerudian
C. perpaipan
D. cathead
- 1.59 Minyak akan mengalir daripada telaga dan terus kepada separator. Apakah fungsi separator?
- I. Untuk mengasingkan gas asli dan minyak.
II. Untuk mengasingkan minyak dan air.
III. Untuk penapisan minyak mentah.
IV. Untuk mengasingkan rincisan gerudi daripada minyak.
- A. Semua di atas C. I, II dan IV
B. I, II dan III D. I dan II
- 1.60 Setelah satu telaga mengeluarkan minyak bagi sesuatu tempoh, ia perlu dimasukkan semula dan diperbaiki. Kerja-kerja ini termasuk menampal untuk membuka zon baru, gerudi lebih dalam untuk ke zon yang baru, memperbaiki selongsong yang bocor, memperbaiki peralatan telaga yang rosak, kerja-kerja stimulasi (pengasidan atau merekahkan formasi) dan lain-lain. Ini biasanya digelar
- A. ulang kerja telaga
B. pelengkapan
C. penebukan
D. masuk ke dalam lubang

(50 marks)

(50 markah)

Subjective questions

Answer any two of the following questions

2. a. Given the analysis in Table 1 of a natural gas produced from an oil well. Compute (i) the gas gravity, and (ii) the pseudo-critical temperature and pressure.

(10 marks)

Table 1

Component in the natural gas	Mol %
methane	79.05
ethane	10.85
propane	4.61
Iso-butane	1.28
n-butane	2.04
Iso-pentane	0.21
n-pentane	0.34
Hexanes	0.84
Heptane +	0.78

Also given the physical properties of light paraffin hydrocarbons and miscellaneous compounds in the

Table 2

Table 2

Compound		Molecular weight	Critical pressure, psia	Critical temperature, °Rankine
Abbreviation of formula	Name			
C ₁	Methane	16.04	673	344
C ₂	Ethane	30.07	709	550
C ₃	Propane	44.09	618	666
iC ₄	iso-Butane	58.12	530	733
nC ₄	normal-Butane	58.12	551	766
iC ₅	iso-Pentane	72.15	482	830
nC ₅	normal-Pentane	72.15	485	847
nC ₆	normal-Hexane	86.17	434	915
nC ₇	normal-Heptane	100.2	397	973
nC ₈	normal-Octane	114.2	370	1025
nC ₉	normal-Nonane	128.3	335	1073
nC ₁₀	normal-Decane	142.3	312	1115
-	Air	28.97	547	239
N ₂	Nitrogen	28.02	492	227
O ₂	Oxygen	32.00	732	278
CO ₂	Carbon Dioxide	44.01	1072	548
H ₂ S	Hydrogen Sulphide	34.08	1306	673
H ₂ O	Water	18.02	3206	1165

Molecular weight of C₇₊ = 140Specific gravity of C₇₊ = 0.85

...16/-

b. What volume will 100 lb of the above gas occupy at $P=3,000$ psig, $T=170^{\circ}\text{F}$?
(8 marks)

c. (i) What is the density of a miscellaneous 0.90 gravity gas at 2,000 psia and 150°F ?
(ii) What is the specific volume at these conditions?
(7 marks)

2. a. Diberi satu analisa di dalam Jadual 1 bagi gas asli daripada pengeluaran telaga minyak. Kirakan graviti gas (ii) suhu dan tekanan pseudo-genting.
(10 markah)

Jadual 1

Komponen dalam gas asli	Mol %
Metana	79.05
etana	10.85
propana	4.61
Iso-butana	1.28
n-butana	2.04
Iso-pentana	0.21
n-pentana	0.34
Hexana	0.84
Heptana +	0.78

Juga diberi sifat fizikal bagi hidrokarbon parafin ringan dan sebatian yang lain serta seperti dalam Jadual 2.

Jadual 2

Kependekan formula	Sebatian		Berat Molikul	Tekanan gentinge, psia	Suhu genting, $^{\circ}\text{Rankine}$
	Nama				
C_1	Metana		16.04	673	344
C_2	Ethana		30.07	709	550
C_3	Propana		44.09	618	666
iC_4	iso-Butana		58.12	530	733
nC_4	normal-Butana		58.12	551	766
iC_5	iso-Pentana		72.15	482	830
nC_5	Pentana-biasa		72.15	485	847
nC_6	Hexana-biasa		86.17	434	915
nC_7	Heptana-biasa		100.2	397	973
nC_8	Octana-biasa		114.2	370	1025
nC_9	Nonana-biasa		128.3	335	1073
nC_{10}	Decana-biasa		142.3	312	1115
-	Udara		28.97	547	239
N_2	Nitrogen		28.02	492	227
O_2	Oksigen		32.00	732	278
CO_2	Karbon Dioksida		44.01	1072	548
H_2S	Hydrogen Sulfida		34.08	1306	673
H_2O	Air		18.02	3206	1165

Berat molikul bagi $C_{7+} = 140$

Graviti tentu $C_{7+} = 0.85$

(10 markah)

b. Apakah isipadu 100 lb gas di atas pada $P= 3,000$ psig, $T=170^{\circ}\text{F}$?

(8 markah)

- c. (i) Apakah ketumpatan gas graviti 0.9 pada 2,000 psia dan 150°F?
 (ii) Apakah isipadu spesifik pada keadaan ini?
 (7 markah)

3. a. In a well completion programme, a liner is planned for a well. A 30-bbl excess volume will be used. The cement will be pumped at 5 bbl/min., which generate 1,000 and 200 psi friction pressure in the drill string and annulus, respectively, above the liner top. The mud and cement densities are 14.4 ppg and 16.4 ppg respectively.

Determine whether loss circulation (unwanted formation fracture) will occur at any of the following conditions:

- (i) the 30-bbl excess volume is above the liner top in a static condition.
 (ii) the 30-bbl excess volume is pumped out of the hole via the annulus, i.e., the "long way".
 (iii) the 30-bbl excess volume is pumped out of hole via the drillpipe, i.e., reversed-out or the "short way".

Following is the information for the calculation:

Drillpipe	=	9,400 feet, 4 ½ inch OD
Drillpipe capacity	=	0.01422 bbl/ft
Liner top	=	9,400 ft
Liner depth	=	12,000 ft
Casing seat	=	10,000 ft
Annulus capacity	=	0.05 bbl/ft
Fracture gradient at 10,000 ft	=	16.8 ppg

(15 marks)

- b. Sketch typical casing string used in well completion of a normally pressured well and an abnormally pressured well.

(10 marks)

3. a. Dalam program pelengkapan telaga, satu pelapik telah dirancang untuk dipasangkan di dalam sebuah telaga. Lebihan isipadu simen sebanyak 30 bbl akan digunakan. Simen akan dipam pada kadar 5 bbl/min., yang akan menjana 1,000 dan 200 psi tekanan geseran dalam talian gerudi dan anulus, masing-masing, di bahagian atas pelapik. Ketumpatan lumpur dan simen ialah 14.4 ppg dan 16.4 ppg masing-masing.

Tentukan sama ada kehilangan aliran (rekahan formasi yang tidak dikehendaki) akan berlaku pada keadaan berikut:

- (i) lebihan isipadu 30 bbl di atas bahagian atas liner dalam keadaan statik.

- (ii) *lebih isipadu 30 bbl dipam keluar daripada lubang melalui anulus, iaitu melalui "jalan jauh".*
- (iii) *lebih 30 bbl dipam keluar melalui paip gerudi, iaitu keluar balikan atau "jalan dekat".*

Berikut adalah maklumat yang diperlukan untuk perkiraan:

<i>Paip gerudi</i>	<i>= 9,400 kaki, 4 ½ inci OD</i>
<i>Kapasiti paip gerudi</i>	<i>= 0.01422 bbl/kaki</i>
<i>Bahagian atas pelapik</i>	<i>= 9,400 kaki</i>
<i>Kedalaman pelapik</i>	<i>= 12,000 kaki</i>
<i>Tempat letak selongsong</i>	<i>= 10,000 kaki</i>
<i>Kapasiti anulus</i>	<i>= 0.05 bbl/kaki</i>
<i>Cerun rekahan pada 10,000 kaki</i>	<i>= 16.8 ppg</i>

(15 markah)

- b. *Lakarkan talian selongsong yang biasa digunakan bagi pelengkapan telaga yang di bawah tekanan biasa dan yang dibawah tekanan tidak biasa.*

(10 markah)

4. a. A drilling rig has eight lines strung through the travelling block. A hook load of 240,000 lb is being hoisted at a velocity of 50 ft/min. Calculate:

- (i) the velocity of the line being spooled at the draw works (this is called the fast line).
- (ii) the line pull at the draw works assuming frictional losses of 2% per working line.
- (iii) the output horsepower of the draw works.

(9 marks)

- b. Write short notes on any four (4) the following topics

- (i) production sharing contract
- (ii) directional drilling
- (iii) christmas tree
- (iv) secondary recovery
- (v) separator in oil production
- (vi) blow out

(16 marks)

4. a. *Sebuah rig penggerudian mempunyai lapan talian melalui blok bergerak. Beban cangkuk 240,000 lb sedang ditarik ke atas pada halaju 50 kaki/min. Kirakan:*

- (i) *halaju talian yang sedang digulung oleh "draw works" (ini digelar talian pantas).*
- (ii) *daya tarikan pada "draw works" dengan mengandaikan kehilangan geseran 2% bagi setiap talian yang berkerja.*
- (iii) *kuasa kuda keluaran daripada "draw works".*

(9 markah)

- b. Tulis nota ringkas bagi empat (4) daripada tajuk-tajuk berikut:
- (i) kontrak perkonsian pengeluaran (PSC)
 - (ii) penggerudian berarah
 - (iii) pepohon krismas
 - (iv) perolehan sekunder
 - (v) pemisah (separator) untuk pengeluaran minyak
 - (vi) semburan liar

(16 markah)

5. (a) With the aid of a sketch, show a cross section of an anticlinal trap for a water drive reservoir. Label your diagram.

(7 marks)

- (b) What are the causes of formation damage and what effect it has on an oil well?

(8 marks)

- (c) A typical permeability distribution around a borehole with the altered zone of permeability k_a extending a distance r_a from the centre of wellbore. The radius of the wellbore is r_w . The reservoir pressure is p_e and drop to p_1 at the altered zone and continue to drop to p_w at the wellbore due to oil production at the rate of q .

Beginning with the Darcy's equation in the form of $\frac{q}{A} = \frac{k}{\mu} \frac{dp}{dr}$ with usual notation. Show that the average permeability of an altered system in an oil well due to formation damage as :

$$\bar{k} = \frac{\ln(r_e / r_w)}{\frac{1}{k_e} \ln(r_e / r_a) + \frac{1}{k_a} \ln(r_a / r_w)}$$

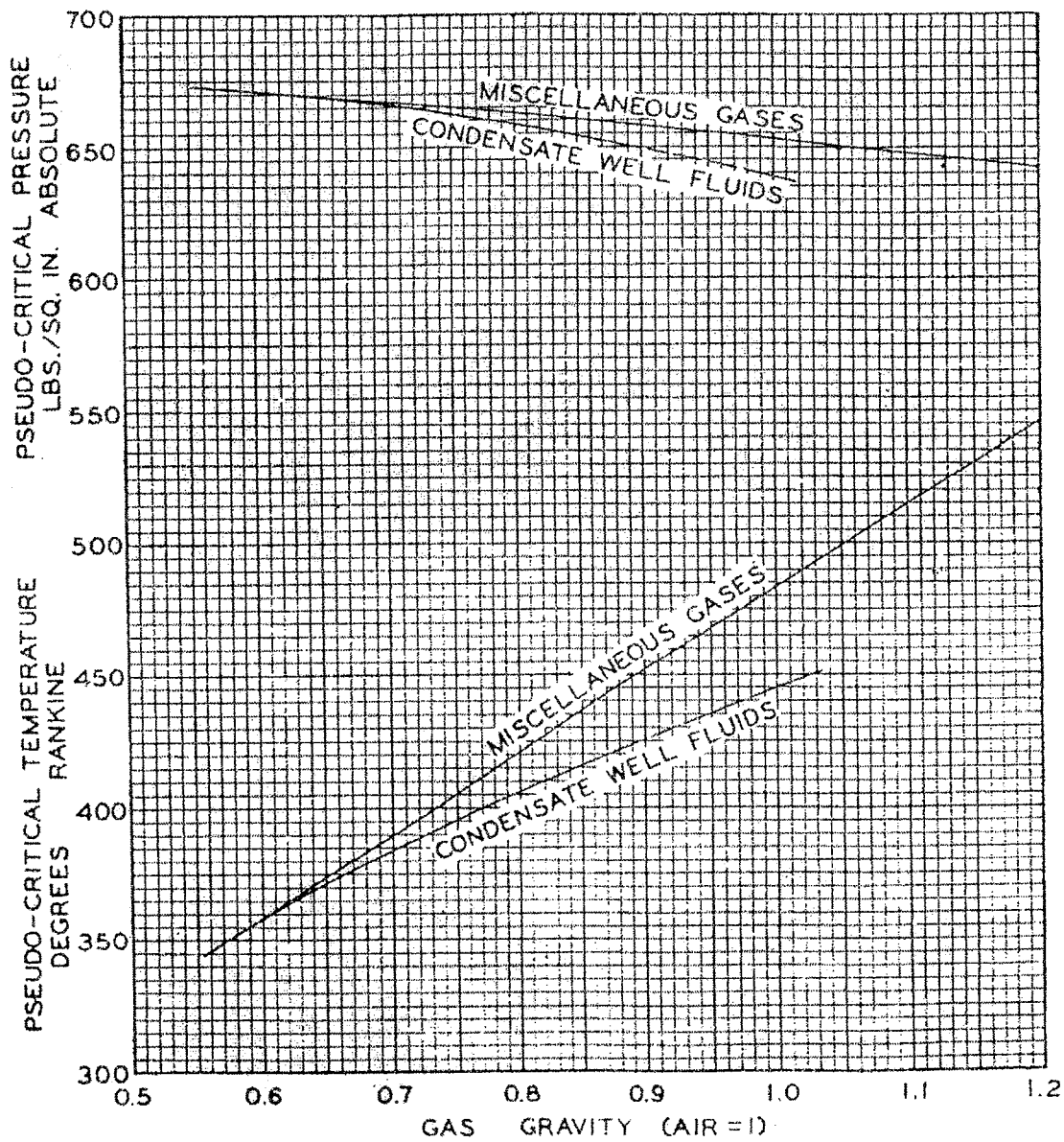
(10 marks)

5. (a) Dengan bantuan suatu lakaran, tunjukkan suatu keratan rentas bagi perangkap antiklin untuk reservoir pacuan air. Labelkan rajah yang anda lakarkan.

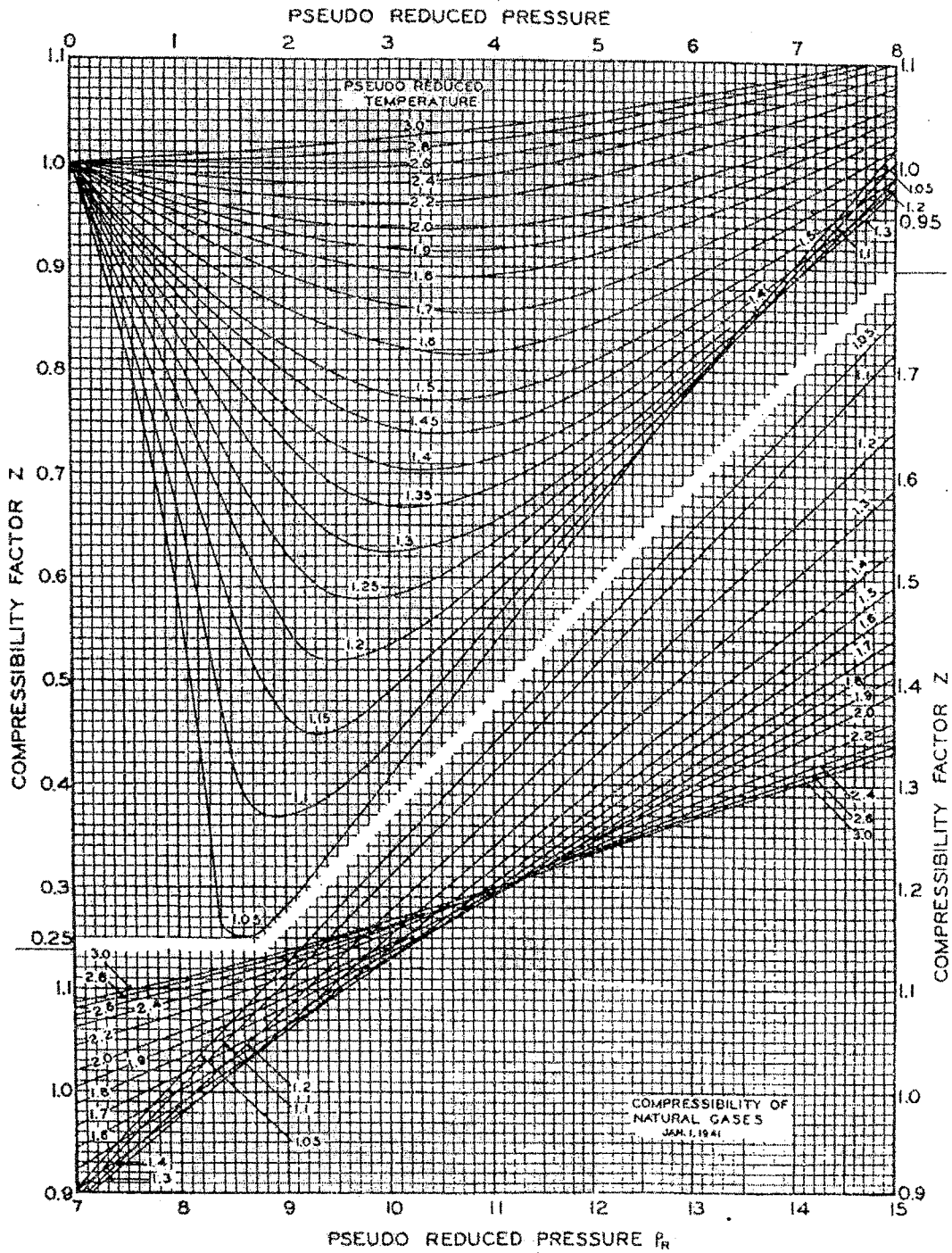
(7 markah)

- (b) Apakah yang menyebabkan berlakunya kerosakan formasi dan apakah kesannya ke atas telaga minyak?

(8 markah)



Pseudo-critical properties of natural gases as functions of gas gravity. Courtesy G. G. Brown, et al



Compressibility of natural gases as a function of reduced pressure and temperature.
After Standing and Katz, courtesy AIME

UNIVERSITI SAINS MALAYSIA
SECOND SEMESTER EXAMINATION 2006/2007
PEPERIKSAAN SEMESTER KEDUA 2006/2007

EBS 418E/3
PETROLEUM ENGINEERING
KEJURUTERAAN PETROLEUM

OBJECTIVE QUESTIONS ANSWER SHEET

Examination Index Number :

Angka Giliran Peperiksaan:

(in words):

(dalam perkataan):

Blacken the correct answer using any suitable pencil.

- | | | |
|----------------------|----------------------|----------------------|
| 1.1 =A= =B= =C= =D= | 1.21 =A= =B= =C= =D= | 1.41 =A= =B= =C= =D= |
| 1.2 =A= =B= =C= =D= | 1.22 =A= =B= =C= =D= | 1.42 =A= =B= =C= =D= |
| 1.3 =A= =B= =C= =D= | 1.23 =A= =B= =C= =D= | 1.43 =A= =B= =C= =D= |
| 1.4 =A= =B= =C= =D= | 1.24 =A= =B= =C= =D= | 1.44 =A= =B= =C= =D= |
| 1.5 =A= =B= =C= =D= | 1.25 =A= =B= =C= =D= | 1.45 =A= =B= =C= =D= |
| 1.6 =A= =B= =C= =D= | 1.26 =A= =B= =C= =D= | 1.46 =A= =B= =C= =D= |
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| 1.16 =A= =B= =C= =D= | 1.36 =A= =B= =C= =D= | 1.56 =A= =B= =C= =D= |
| 1.17 =A= =B= =C= =D= | 1.37 =A= =B= =C= =D= | 1.57 =A= =B= =C= =D= |
| 1.18 =A= =B= =C= =D= | 1.38 =A= =B= =C= =D= | 1.58 =A= =B= =C= =D= |
| 1.19 =A= =B= =C= =D= | 1.39 =A= =B= =C= =D= | 1.59 =A= =B= =C= =D= |
| 1.20 =A= =B= =C= =D= | 1.40 =A= =B= =C= =D= | 1.60 =A= =B= =C= =D= |