



Final Examination
2018/2019 Academic Session

June 2019

JIK102 – General Chemistry II
(Kimia Am II)

Duration : 3 hours
(Masa : 3 jam)

Please check that this examination paper consists of **ELEVEN (11)** pages of printed material before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **SEBELAS (11)** muka surat yang bercetak sebelum anda memulakan peperiksaan ini].*

Instructions : Answer **FIVE (5)** questions. Answer the questions in English. You may also answer the questions in Bahasa Malaysia, but not a mix of both languages.

[Arahan : Jawab **LIMA (5)** soalan. Jawab soalan-soalan dalam Bahasa Inggeris. Anda juga dibenarkan menjawab soalan dalam Bahasa Malaysia, tetapi campuran antara kedua-dua bahasa ini tidak dibenarkan].

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai].

1. (a). Define calorimetry and describe two commonly used calorimeters. In calorimetric measurement, why is it important that we know the heat capacity of the calorimeter? How is this value determined?

Takrifkan kalorimetri dan terangkan dua penggunaan umum kalorimeter. Dalam pengukuran kalorimetrik, mengapakah sangat penting untuk kita mengetahui muatan haba kalorimeter tersebut? Bagaimanakah nilai ditentukan?

(5 marks/markah)

- (b). A 50.75 g sample of water at 75.6 °C is added to a sample of water at 24.1 °C in a constant pressure calorimeter. If the final temperature of the combined water is 39.4 °C and the heat capacity of the calorimeter is 26.3 J/°C, calculate the mass of the water originally in the calorimeter.

Suatu sampel air berjisim 50.75 g pada 75.6 °C ditambah kepada satu sampel air pada 24.1 °C dalam kalorimeter bertekanan tetap. Sekiranya suhu akhir campuran air tersebut ialah 39.4 °C dan muatan haba kalorimeter tersebut ialah 26.3 J/°C, kirakan jisim air asal dalam kalorimeter.

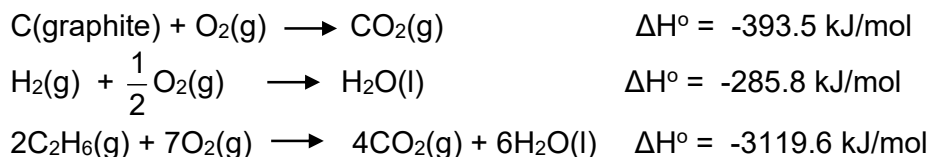
(5 marks/markah)

- (c). (i). State Hess's law. Explain, with one example, the usefulness of Hess's law in thermochemistry.

Nyatakan Hukum Hess. Jelaskan dengan satu contoh kegunaan Hukum Hess dalam termokimia.

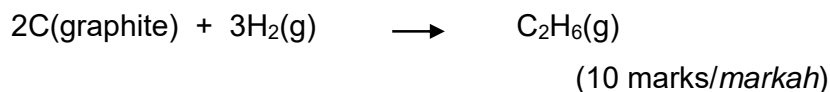
(ii). From the following data,

Dari data berikut,



Calculate the enthalpy change for the reaction below:

Kirakan perubahan entalpi untuk tindak balas di bawah:



2. (a). What is difference between the terms gas and vapor? At 25 °C, which of the following diatomic molecules chlorine and diatomic molecules iodine in the gas phase should be properly called a gas and which should be called a vapor?

Apakah berbezaan di antara terma gas wap? Pada 25 °C yang manakah antara molekul diatom klorin dan molekul diatom iodin dalam fasa gas yang sepatutnya digelar gas dan yang mana harus digelar wap?

(6 marks/markah)

- (b). A gas sample occupying a volume of 29.8 mL at a pressure of 0.870 atm is allowed to expand at constant temperature until its pressure reaches 0.433 atm. What is the final volume of the gas?

Suatu sampel gas memenuhi isipadu 29.8 mL pada tekanan 0.870 atm dibenarkan untuk mengembang pada suhu tetap sehingga tekanannya mencapai 0.433 atm. Apakah isipadu akhir gas tersebut?

(6 marks/markah)

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- (c). Ozone molecules in the stratosphere absorb much of the harmful radiation from the sun. Typically, the temperature and pressure of ozone in the stratosphere are 250 K and 1.0×10^{-3} atm, respectively. How many ozone molecules are present in 1.0 L of air under these conditions?

Molekul-molekul ozon dalam stratosfera menyerap banyak radiasi yang berbahaya daripada matahari. Kebiasaannya, suhu dan tekanan ozon dalam stratosfera ialah 250 K dan 1.0×10^{-3} atm masing-masing. Berapa bilangan molekul ozon yang hadir dalam 1.0 L udara di bawah keadaan ini.

(8 marks/markah)

3. (a). What physical properties are determined by the strength of intermolecular forces in solids and liquids?

Apakah ciri-ciri fizikal yang ditentukan oleh kekuatan daya antara dalam pepejal dan cecair?

(5 marks/markah)

- (b). A length of wire is placed on top of a block of ice. The end of the wire extend over the edge of the ice, and a heavy weight is attached to each end. It is found that the ice under the wire gradually melts, so the wire slowly moves through the ice block. At the same time, the water above the wire refreezes. Explain the phase changes that accompany this phenomenon.

Suatu wayar panjang diletakkan di bahagian atas blok ais. Hujung wayar diletakkan pada penjuru blok ais dan suatu pemberat dilekatkan pada setiap hujung wayar. Didapati ais di bawah wayar tersebut mencair secara berterusan, oleh itu wayar tersebut bergerak merentasi blok ais tersebut. Pada masa yang sama, air di atas wayar kembali membeku. Jelaskan perubahan fasa yang menuruti fenomena ini.

(5 marks/markah)

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- (c). The boiling point and freezing point of sulfur dioxide are $-10\text{ }^{\circ}\text{C}$ and $-72.7\text{ }^{\circ}\text{C}$ (at 1 atm), respectively. The triple point is $-75.5\text{ }^{\circ}\text{C}$ and 1.65×10^{-3} atm, and its critical point is at $157\text{ }^{\circ}\text{C}$ and 78 atm. From this information, draw a rough sketch of the phase diagram of SO_2 .

Takat didih dan takat beku sulfur dioksida ialah $-10\text{ }^{\circ}\text{C}$ dan $-72.7\text{ }^{\circ}\text{C}$ (pada 1 atm), masing-masing. Titik tigaan ialah $-75.5\text{ }^{\circ}\text{C}$ dan 1.65×10^{-3} dan titik kritikal ialah pada $157\text{ }^{\circ}\text{C}$ dan 78 atm. Daripada maklumat ini, lakarkan gambar rajah fasa SO_2 .

(10 marks/markah)

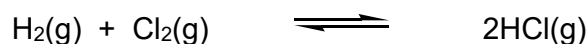
4. (a). What is Le Chatelier's principle? Use Le Chatelier's principle to explain why the equilibrium vapour pressure of a liquid increases with increasing temperature?

Apakah prinsip Le Chatelier? Gunakan prinsip Le Chatelier untuk jelaskan mengapa keseimbangan tekanan wap cecair meningkat dengan peningkatan suhu?

(5 marks/markah)

- (b). A mixture of 0.47 mole of H_2 and 3.59 moles of HCl is heated to $2800\text{ }^{\circ}\text{C}$. Calculate the equilibrium partial pressure of H_2 , Cl_2 and HCl if the total pressure is 2.00 atm. For the reaction

Suatu campuran 0.47 mol H_2 dan 3.59 mol HCl dipanaskan sehingga $2800\text{ }^{\circ}\text{C}$. Kirakan keseimbangan tekanan separa H_2 , Cl_2 dan HCl sekiranya jumlah tekanan ialah 2.00 atm. Untuk tindak balas



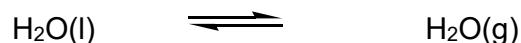
K_P is 193 at $2800\text{ }^{\circ}\text{C}$.

(10 marks/markah)

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- (c). At 20 °C, the vapour pressure of water is 0.0231 atm. Calculate K_P and K_C for the process

Pada 20 °C, tekanan wap air ialah 0.0231 atm. Kirakan K_P dan K_C untuk proses ini.



(5 marks/markah)

5. (a). The following names are all incorrect or incomplete but they represent real structures. Draw each structure and name it correctly according to IUPAC system.

Nama berikut adalah salah atau tidak lengkap tetapi ia mewakili struktur sebenar. Lukiskan setiap struktur dan berikan nama yang betul mengikut sistem IUPAC.

- (i). 2-ethylpentane

2-etilpentana

- (ii). 2,2-dimethyl-6-ethylheptane

2,2-dimetil-6-etilheptana

- (iii). 5-chloro-4-methylhexane

5-kloro-4-metilheksana

- (iv). (Z)-3-chloro-2-butene

(Z)-3-kloro-2-butena

(8 marks/markah)

- (b). Draw the chemical structure and give the IUPAC name of an alkane with a molecular formula C_7H_{16} that contains:

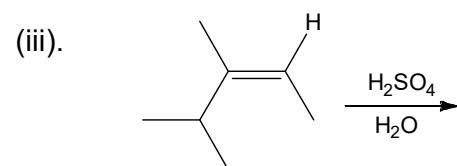
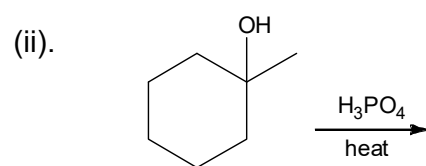
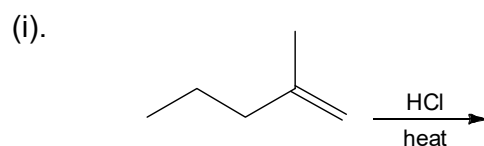
Lukiskan struktur kimia dan berikan nama IUPAC bagi suatu alkana dengan formula molekul C_7H_{16} yang mengandungi:

- (i). Primary (1°), secondary (2°) and tertiary (3°) hydrogens
Hidrogen primer (1°), sekunder (2°) dan tertier (3°)
- (ii). Only primary (1°) and secondary (2°) carbons
Hanya karbon primer (1°) dan sekunder (2°)
- (iii). One quaternary carbon
Satu karbon kuartener

(6 marks/markah)

- (c). Draw the major product of the followings reactions:

Lukiskan hasil utama bagi tindak balas berikut:



(6 marks/markah)

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6. (a). Propose structures for molecules that meet the following descriptions:
Cadangkan struktur bagi molekul yang memenuhi keterangan yang berikut:

(i). Contains two sp^2 -hybridized carbons and one sp^3 hybridized carbons.
Mempunyai dua karbon terhibrid sp^2 dan satu karbon terhibrid sp^3 .

(ii). Contains four sp^3 -hybridized carbons.
Mempunyai empat karbon terhibrid sp^3 .

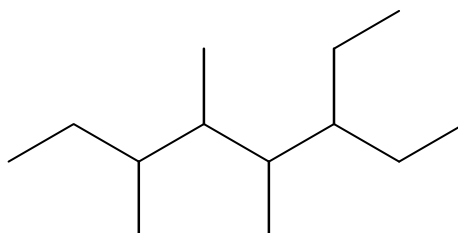
(iii). Contains two sp -hybridized carbons and two sp^2 -hybridized carbons.
Mempunyai dua karbon terhibrid sp dan dua karbon terhibrid sp^2 .

(6 marks/markah)

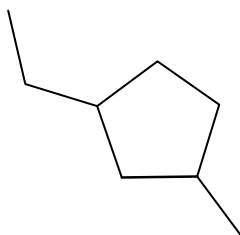
(b). Give IUPAC names for the following hydrocarbons:

Berikan nama IUPAC bagi hidrokarbon berikut:

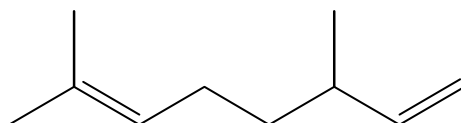
(i).



(ii).



(iii).



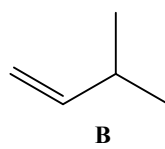
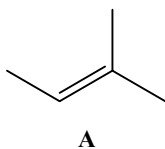
(6 marks/markah)

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- (c). Compounds **A** and **B** are the products that obtained from the dehydration reaction between an alcohol **C** and sulphuric acid.

Sebatian A dan B adalah hasil yang diperolehi daripada tindak balas pendehidratan suatu alkohol C dengan asid sulfurik.

- (i). Suggest a reasonable structure of **C**.
Cadangkan struktur C yang munasabah.
- (ii). Indicate the major and minor products. Explain.
Nyatakan hasil utama dan sampingan. Jelaskan.
- (iii). Write the mechanism for reaction.
Tuliskan mekanisme tindak balas.



(8 marks/markah)

APPENDIX

Table 1

Specific Heat Values of Some Common Substances	
Substance	Specific Heat (J/g. °C)
Al(s)	0.900
Au(s)	0.129
C(graphite)	0.720
C(diamond)	0.502
Cu(s)	0.385
Fe(s)	0.444
Hg(l)	0.139
H ₂ O(l)	4.184
C ₂ H ₅ OH(l) -ethanol	2.46

Avogadro's number = 6.022×10^{23}

IUPAC Periodic Table of the Elements

1 H hydrogen [1.007 1429]																	18 He helium [4.002 602]	
3 Li lithium [6.939 1512]	4 Be beryllium [9.012 2087]																	9 F fluorine [18.998 4032]
11 Na sodium [22.989 7692]	12 Mg magnesium [24.304 0898]	13 B boron [10.811 7385]	14 C carbon [12.010 7395]	15 N nitrogen [14.006 4224]	16 O oxygen [15.999 4316]	17 Cl chlorine [35.453 6808]							18 Ar argon [39.948 4018]					
19 K potassium [39.098 3107]	20 Ca calcium [40.078 4008]	21 Sc scandium [44.955 9122]	22 Ti titanium [47.867 4008]	23 V vanadium [50.942 4008]	24 Cr chromium [51.996 1463]	25 Mn manganese [54.938 0443]	26 Fe iron [55.845 2603]	27 Co cobalt [58.933 1962]	28 Ni nickel [58.693 4008]	29 Cu copper [63.546 3009]	30 Zn zinc [65.38 4008]	31 Ga gallium [69.723 4008]	32 Ge germanium [72.63 4008]	33 As arsenic [74.921 6008]	34 Se selenium [78.972 4008]	35 Br bromine [79.904 4008]	36 Kr krypton [83.80 4008]	
37 Rb rubidium [85.468 4008]	38 Sr strontium [87.62 4008]	39 Y yttrium [88.906 4008]	40 Zr zirconium [91.224 4008]	41 Nb niobium [92.906 4008]	42 Mo molybdenum [95.94 4008]	43 Tc technetium [98 4008]	44 Ru ruthenium [101.07 4008]	45 Rh rhodium [102.905 4008]	46 Pd palladium [106.365 4008]	47 Ag silver [107.868 4008]	48 Cd cadmium [112.411 4008]	49 In indium [114.818 4008]	50 Sn tin [118.710 4008]	51 Sb antimony [121.757 4008]	52 Te tellurium [127.6 4008]	53 I iodine [126.905 4008]	54 Xe xenon [131.29 4008]	
55 Cs caesium [132.905 4008]	56 Ba barium [137.327 4008]	57-71 Lanthanoids	72 Hf hafnium [178.49 4008]	73 Ta tantalum [180.948 4008]	74 W tungsten [183.84 4008]	75 Re rhenium [186.207 4008]	76 Os osmium [190.23 4008]	77 Ir iridium [192.222 4008]	78 Pt platinum [195.084 4008]	79 Au gold [196.967 4008]	80 Hg mercury [200.59 4008]	81 Tl thallium [204.384 4008]	82 Pb lead [207.2 4008]	83 Bi bismuth [208.980 4008]	84 Po polonium [209 4008]	85 At astatine [210 4008]	86 Rn radon [222 4008]	
87 Fr francium [223 4008]	88 Ra radium [226 4008]	89-103 actinoids	104 Rf rutherfordium	105 Db dubnium	106 Sg seaborgium	107 Bh bohrium	108 Hs hassium	109 Mt meitnerium	110 Ds darmstadtium	111 Rg roentgenium	112 Cn copernicium	113 Uut ununtrium	114 Fl flerovium	115 Uup ununpentium	116 Lv livermorium	117 Uus ununseptium	118 Uuo ununoctium	
89 La lanthanum [138.905 4008]	90 Ce cerium [140.12 4008]	91 Pr praseodymium [140.907 4008]	92 Nd neodymium [144.24 4008]	93 Pm promethium [144.913 4008]	94 Sm samarium [150.36 4008]	95 Eu europium [151.964 4008]	96 Gd gadolinium [157.25 4008]	97 Tb terbium [158.925 4008]	98 Dy dysprosium [162.50 4008]	99 Ho holmium [164.930 4008]	100 Er erbium [167.259 4008]	101 Tm thulium [168.934 4008]	102 Yb ytterbium [173.054 4008]	103 Lu lutetium [174.967 4008]	104 Uuq ununquadium	105 Uub ununbium	106 Uuq ununquadium	107 Uuo ununoctium

Key:
atomic number
symbol
name
relative atomic weight



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