SAMPEL PERCUMA

Modul g-CAKNA STPM 2022 Kimia Semester 1 (Set 1 dan Set 2)

Set penuh: Kertas Percubaan STPM

Sem 1 · Kimia

Sampel ini: 8 muka surat. Set penuh ada:

- 3 fail PDF
- Semester 1: kertas percubaan (trial) negeri, subjek yang dipilih + skema
- Blueprint 30 hari Semester 1 (setiap subjek)
- Semester 3: percubaan 2024, 10 subjek, banyak negeri, soalan + skema dalam satu fail

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962/1 STPM 2022

MODUL g -CAKNA STPM PAPER 1
CHEMISTRY 1 (KIMIA)
SET 1
One and a half hours (Satu jam setengah)

SIJIL TINGGI PERSEKOLAHAN MALAYSIA
(MALAYSIA HIGHER SCHOOL CERTIFICATE)

Instructions to candidates:

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Answer **all** *questions in Section A.*

Answer **all** *questions in Section B.*

Answer **two** *questions only in Section C.*

All working should be shown. For numerical answers, unit should be quoted wherever appropriate.

Answers may be written in either English or Malay.

Arahan kepada calon

JANGAN BUKA KERTAS SOALAN INI SEHINGGA ANDA DIBENARKAN BERBUAT DEMIKIAN

Jawab **semua** *soalan dalam Bahagian A.*

Jawab **semua** *soalan dalam Bahagian B.*

Jawab **dua** *soalan sahaja dalam Bahagian C.*

Semua kerja yang hendaklah ditunjukkan. Bagi jawapan berangka, unit hendaklah dinyatakan di mana-mana yang sesuai.

Jawapan boleh ditulis dalam bahasa Inggeris atau Bahasa Malaysia.

For examiner‟s use (Untuk kegunaan pemeriksa)	
Section A	
Section B (*Bahagian B*)	
16	
17	
Section C (*Bahagian C*)	
Total (Jumlah)	

This question paper consists of 10 printed pages
(Kertas soalan ini terdiri daripada 10 halaman bercetak)

Section A [15 *marks*]

Answer **all** *questions.*

Indicate the correct answer on the Multiple-choice Answer Sheet provided.

1 The proton number of ion Y is 16, its nucleon number is 33 and it has the same number of electrons and neutrons. What is the charge of ion Y?

A -2

B -1

C +1

D +2

2 A solution is prepared by dissolving 14.9 g XCl in water. When excess silver nitrate solution is added to the solution, 28.7g of silver chloride precipitate is formed. What is the relative atomic mass of X?

A 11.0

B 39.0

C 46.5

D 74.5

3 Which statement is true of an emission spectrum of hydrogen atom?

A The spectrum is similar to that of He^+ ion.

B The Lyman series and the Balmer series have the same number of lines.

C The first visible line has the shortest wavelength.

D The ionization energy of the hydrogen atom can be determined from the continuum of the Balmer series.

4 Which statement in **not** true about *s,p* and *d* orbitals?

A Three 2p orbitals have the same shape and energy.

B The size of 1s orbital is smaller than that of 2p orbitals.

C 2s orbital is non-directional whereas $2p_x$ orbital is directional.

D Vacant 3d orbitals are at lower energy level than a vacant 4s orbital.

5 Most ionic compounds are solids. Which compound is **not** an ionic compound?

A AlF_3

B $BeCl_2$

C NH_4Br

D KI_3

6 The shapes of molecules and polyatomic ions could be determined using the VSEPR theory. Which species has the smallest bond angle?

A $BeCl_2$

B BF_3

C CO_3^{2-}

D SO_4^{2-}

7 The atomic number of several elements represented by letters which are not the usual symbols for the element concerned in the Periodic Table is shown in the table below.

Element	W	X	Y	Z
Atomic number	3	11	13	26

Which element has the strongest metallic bond?

A W

B X

C Y

D Z

8 Gas X is collected in a 250cm^3 volumetric flask at 25^{o}C until the pressure of the gas is 73.5 kPa. The mass of X in the flask is 0.118 g at 25^{o}C. What is the mass of 1 mol of X?

A 7.42 g

B 11.3 g

C 14.6 g

D 15.9 g

9 Which of the following is true of glucose solution as compared to pure water?

A Both the glucose solution and water have the same triple point

B The melting point of the glucose solution is higher than water

C The boiling point of the glucose solution is higher than water

D The vapour pressure of the glucose solution is higher than water

10 The equation for the reaction between P and Q is shown below.

$$2P\ (g) + Q\ (g) \longrightarrow R\ (g)$$

The rate of reaction increased eight times when the concentration of P and Q were doubled. Which statement is true about the reaction?

A It is a third-order reaction

B The number of collisions increases eight times

C Average molecular speed of P and Q increases eight times

D It is a second-order reaction with respect to the concentration of P

11 The rate equation for the reaction between X and Y is as follows:

$$\text{Rate} = k[X][Y]^2$$

When 0.20 mol gas X and 0.10 mol gas Y are mixed in a 2.0 dm^3 vessel at 300°C, the initial rate is 3.2×10^{-4} $moldm^{-3}$ s^{-1}. Which statement is true of the reaction?

A the rate of reaction is eight times lower in a 4.0 dm^3 vessel

B the numerical value of k is 0.16 at 300°C

C the rate-determining step is bimolecular

D the unit of *k* is $dm^3mol^{-1}s^{-1}$

12 The reforming of methane is the principal commercial source of hydrogen gas. The equation for the endothermic reaction involved is as follows:

$$CH_4\,(g) + H_2O \rightleftharpoons CO\,(g) + 3H_2\,(g)$$

At equilibrium, the quantity of hydrogen gas formed can be increased by

A adding a suitable catalyst

B increasing the temperature

C adding a dehydrating agent

D reducing the volume of the vessel

13 The autoionization of water is an endothermic process. The ionic product of water, Kw is 1.0×10^{-14} mol^2 dm^{-6} at 298 K and increases ten times when the temperature is increased to 334 K.
What is the pH of water at 334 K?

A 13

B 7.5

C 7.0

D 6.5

14 The solubility product of magnesium carbonate is 4.00×10^{-5} mol^2 dm^{-6}. What is the mass of magnesium carbonate precipitated when 25.0 cm^3 of an aqueous solution of 0.500 mol dm^{-3} magnesium nitrate is added to 25.0 cm^3 of an aqueous solution of 0.500 mol dm^{-3} sodium carbonate?
[The relative molecular mass of $MgCO_3$ is 84.3]

A 0.0533 g

B 0.250 g

C 1.03 g

D 1.05 g

Section B [*15 marks*]

Answer **all** *questions*.

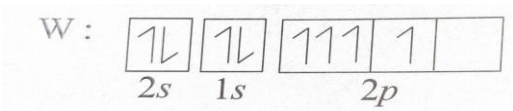
Write the answers in the spaces provided.

16 **W** has 8 electrons**.** It is a highly reactive non-metal and an oxidizing agent that readily forms oxides with most element as well as with other compounds.

i. Define orbital. [1]

……

ii. Explain which rule is violated in the following electronics configuration. [3]



……

……

……

……

……

ii. Draw the shape of valence orbitals for W. [3]

Section C [*30 marks*]

Answer **two** *questions only.*

Your may answer all the questions **but**, *only the first* **two** *answers will be marked. Write the answers on the answer sheets provided. Begin each answer on the new page of the answer sheet.*

18 (*a*) Give the definition of the covalent bonding and hydrogen bonding. Illustrate your answer by using Cl_2 and HF as the examples. [4]

(*b*) Explain the trend in the boiling point of the following compounds. [5]

Compound	CH_4	NH_3	H_2O
Boiling point/^oC	-165	-33	100

(c) The boiling points and solubility of hydrogen chloride, carbon dioxide and ammonia are given below.

Compound	Boiling point/^oC	Solubility in water/mol dm^{-3} at 298 K
Hydrogen chloride	-85	23
Carbon dioxide	-78	0.03
Ammonia	-33	18

Explain in terms of intermolecular forces the differences in boiling points between

(i) Hydrogen chloride and carbon dioxide, [2]

(ii) Ammonia and hydrogen chloride. [2]

(iii) Explain why the solubility of ammonia and hydrogen chloride is so much higher than that of carbon dioxide. [3]

19 (a) Most matters can exist in three physical states that are dependent on temperature and pressure. The transformation between the physical states of substance is best represented by a phase diagram.

The table below list the temperature and pressure for the critical point and the triple point of substance :

	Temperature/^oC	Pressure / atm
Critical point	31	73
Triple point	-57	5

Z sublimes at -78^oC under atmosphere pressure. The freezing point of Z increase by 2^oC for every increase of 10 atm in pressure.

(i) Based on the information given above, sketch the phase diagram of Z [4]

ANSWER SET 1

SECTION A [*15 marks*]

<table>
<tr><th>QN. NU</th><th>ANS</th><th>EXPLANATIONS</th></tr>
<tr><td>1</td><td>B</td><td>Nu. Of neutron = Nucleon number -proton number
= 33-16
= 17
Number of electrons = 17 and number of protons =16
The charge on ion Y = -1</td></tr>
<tr><td>2</td><td>B</td><td>$XCl(aq) + AgNO_3 \rightarrow XNO_3 + AgCl$

Mass of XCl required to produce 1 mol (143.5 g) of AgCl
= 143.5/28.7 x 14.9
=74.5 g

Let the A_r of X = a g
(a + 35.5) = 74.5
a = 39.0</td></tr>
<tr><td>3</td><td>A</td><td>Both H and He^+ have only one electron in their structure, so they will have similar line spectrum.</td></tr>
<tr><td>4</td><td>D</td><td>Vacant 4s orbitals have energy that is lower than that of 3d orbitals.</td></tr>
<tr><td>5</td><td>B</td><td><table><tr><td>AlF_3</td><td>$BeCl_2$</td><td>NH_4Br</td><td>KI_3</td></tr><tr><td>Ionic</td><td>Covalent</td><td>Ionic</td><td>Ionic</td></tr></table></td></tr>
<tr><td>6</td><td>D</td><td><table><tr><td></td><td>Shape</td><td>Bond angle</td></tr><tr><td>$BeCl_2$</td><td>Linear</td><td>180°</td></tr><tr><td>BF_3</td><td>Trigonal planar</td><td>120°</td></tr><tr><td>CO_3^{2-}</td><td>Trigonal planar</td><td>120°</td></tr><tr><td>SO_4^{2-}</td><td>Tetrahedral</td><td>109.5°</td></tr></table></td></tr>
<tr><td>7</td><td>D</td><td>W, X, Y and Z are metals which form metallic bonds. However, Z is a transition element. Z can make use of the 4s as well as the 3d electrons to form metallic bonds. Thus, the metallic bond in Z is the strongest.</td></tr>
<tr><td>8</td><td>D</td><td>Assuming the gas shows ideal behavior.
Using the ideal gas equation :pV= nRT
$(73.5 \times 10^3)(250 \times 10^{-6}) = n \times 8.31 \times (23+273)$
$n = 7.4 \times 10^{-3}$ mol

Mr $= 0.118/7.4 \times 10^{-3}$
= 15.9
So, molar mass of X = 15.9 g mol^{-1}</td></tr>
<tr><td>9</td><td>C</td><td>Addition of non volatile solute, glucose decreases the vapour pressure, increases the boiling point and decreases the melting point of water.</td></tr>
<tr><td>10</td><td>A</td><td>Since the rate = k $[P]^a [Q]^b$ => 8 x rate = k x 23 ; therefore overall order is 3rd order.</td></tr>
<tr><td>11</td><td>A</td><td>When volume of vessel is doubled,
Rate $= k[X/2][Y/2]^2$
$= 1/8\ k[X][Y]^2$
$3.2 \times 10^{-4} = k(0.20/2.0)(0.10/2.0)^2$
$k = 1.28\ dm^6mol^{-2}s^{-1}$
rate -determining step involves 3 molecules, that means the unit of k is $dm^6mol^{-2}\ s^{-1}$</td></tr>
</table>

QUE	EXPLANATIONS	MARK
17		
i.	1st order reaction.	1
	Because rate constant unit is s^{-1}	1
ii.	$\ln \frac{k_2}{k_1} = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$ **OR**	
	$\ln \frac{6.61 \times 10^{-5}}{1.74 \times 10^{-5}} = \frac{E_a}{8.314}\left(\frac{1}{298} - \frac{1}{308}\right)$	1
	$1.335 = E_a \times 1.31 \times 10^{-5}$	
	$E_a = 102$ kJmol^{-1}	1
	$k = Ae^{\frac{-E_a}{RT}}$ **OR**	
	$1.74 \times 10^{-5} = Ae^{-\frac{101.9 \times 10^3}{8.314 \times 298}}$	1
	$1.74 \times 10^{-5} = (1.374 \times 10^{-18})A$	
	$A = 1.267 \times 10^{13}$	1
iii.		
	Rate of reaction will increase	1
	A catalyst provides an alternative pathway with a lower activation energy	1
	Total marks	8m

SECTION C [*30 marks*]

QU. NU	EXPLANATIONS	MARK
18		
	(a) Covalent bond is the electrostatic attraction between adjacent nuclei and the electron that are shared between them.	1
	An example is Cl_2. Each chlorine atom shares one of its unpaired valence electron with another chlorine atom so that both achieve octet configurations.	1
	In the HF molecule, the hydrogen atom is bonded to a very small and highly electronegative fluorine atom.	1
	H-F ---- H-F ↑ Hydrogen bonding	1
	(b) NH_3 and H_2O have intermolecular hydrogen bonding while	1
	weak van der Waals forces exist between CH_4 molecules.	1
	H_2O has two lone pair of electrons compared to only one for NH_3.	1
	Thus, H_2O can form more intermolecular hydrogen bonding with one another.	1
	On top of that, oxygen being more electronegative than nitrogen forms stronger hydrogen bond.	1

TAMAT SAMPEL

Suka sampel ini?

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- 3 fail PDF
- Semester 1: kertas percubaan (trial) negeri, subjek yang dipilih + skema
- Blueprint 30 hari Semester 1 (setiap subjek)
- Semester 3: percubaan 2024, 10 subjek, banyak negeri, soalan + skema dalam satu fail

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