SAMPEL PERCUMA

Modul Penggal 1 STPM 2019 Kimia (Set 2)

Set penuh: Kertas Percubaan STPM

Sem 1 · Kimia

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SECTION A [15 marks]

*Answer **all** questions*

1 *Which of the following ions will be deflected most in a mass spectrometer ?*

A $^{35}Cl^{+}$

B $^{37}Cl^{+}$

C $^{35}Cl_2^{+}$

D $^{35}Cl^{37}Cl^{+}$

2 *Which of the following ions contains half-filled d-orbitals ?*

A Mn^{+}

B Cr^{2+}

C Fe^{2+}

D Cu^{+}

3 *Which of the following contains 3 unpaired electrons ?*

A Cr^{3+} , Al^{3+} , Cu^{2+}

B Cr^{3+} , Al^{3+}

C Al^{3+} , Cu^{2+}

D Cr^{3+}

4 *Which of the following will **not** form a hydrogen bond with another of its own molecule ?*

A CH_3OH

B CH_3CHO

C CH_3NH_2

D CH_3COOH

5 *Which of the following statements is correct ?*

A *any covalent compounds that contain both hydrogen and oxygen in its molecule can form hydrogen bond*

B *a covalent molecule cannot be an electrolyte*

C *compared to ionic compounds, covalent compounds are generally more soluble in polar solvent*

D ionic compounds can be distinguished from metals by their electrical conductivity
in the solid and liquid states

6 Which of the following molecules has the smallest bond angles ?

A H_2O

B BF_3

C NH_3

D $BeCl_2$

7 Which one of the following gas samples contains the **greatest** number of moles ?

A 50 dm^3 at 1 atm and 400 K

B 40 dm^3 at 2 atm and 500 K

C 30 dm^3 at 3 atm and 600 K

D 20 dm^3 at 4 atm and 700 K

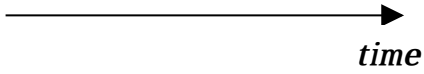
8 Graphite can be used as a lubricant but diamond cannot. This is because graphite has

A mobile ions

B delocalised electrons

C a hexagonal arrangement of atoms in the layers

D van der Waals forces between the layers of atoms



11 Which of the following is true about the effect of a catalyst ?

A It affects the position of equilibrium in a reversible reaction

B It affects the enthalpy change of a reaction

C It increases the rate of forward reaction

D It increases the equilibrium constant for the forward reaction

12 For which equilibrium does K_c have no unit ?

A $C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2(g)$

B $Cu^{2+}(aq) + 4\,NH_3(aq) \rightleftharpoons [\,Cu(NH_3)_4\,]^{2+}(aq)$

C $N_2O_4(g) \rightleftharpoons 2\,NO_2(g)$

D $CH_3OH(l) + CH_3CO_2H(l) \rightleftharpoons CH_3CO_2CH_3(l) + H_2O(l)$

13 What is the pH of the solution formed when 50 cm^3 of 0.50 mol dm^{-3} sulphuric acid is added to 50 cm^3 of 0.50 mol dm^{-3} sodium hydroxide ?

A 0.6 B 1.2

C 7.0 D 13.4

14 The solubility products of silver chloride and silver chromate(VI) at 298 K are as follows:
$K_{sp}(AgCl) = 1.0 \times 10^{-10}\ mol^2\ dm^{-6}$
$K_{sp}(Ag_2CrO_4) = 2.5 \times 10^{-12}\ mol^3\ dm^{-9}$
Which of the following statements is **not** true ?

A Addition of hydrochloric acid decreases the solubility of silver chloride

B Addition of aqueous sodium chloride decreases the solubility of silver chloride

C Addition of aqueous ammonia increases the solubility both of silver chloride and silver chromate(VI)

D Addition of silver nitrate into a solution containing equal concentrations of chloride and chromate ions precipitates a white solid first

15 An aqueous solution containing X^{2+} ions forms a precipitate when an aqueous solution of sodium hydroxide is added to it. The solubility of the precipitate is $9.86 \times 10^{-3}\ gdm^{-3}$ and its solubility product is $1.96 \times 10^{-11}\ mol^3\ dm^{-9}$ at 25 °C. What

is the relative molecular mass of the precipitate ?

A 31.3 *B* 58.0

C 74.0 *D* 99.4

Section B [15 marks]
Answer **all** *questions in this section.*

16 The table shows the physical properties of a substance *P*.

Stage	*Triple point*	*Critical point*
Temperature (°C)	0.01	374.1
Pressure (atm)	0.006	218.3

(a) Based on the above data, sketch and label the phase diagram of the substance *P*. [2 marks]



(b) Suggest a chemical compound that has a similar pattern. [1 mark]

.....

(c) Explain the anomalous behaviour of the substance *P*. [2 marks]

.....

.....

(d) At the same diagram in (a), sketch a diagram to show the effect of glucose dissolves in the substance *P*. [1 mark]

17 Experiment were conducted to study the rate of reaction represented by the equation below :

$2NO(g) + 2H_2(g) \rightarrow N_2(g) + 2H_2O(g)$

Initial concentrations and rates of reaction are given in the table below.

Experiment	Initial Concentration($moldm^{-3}$)		Initial rate of formation of N_2 ($mol\ dm^{-3}\ min^{-1}$)
	$[NO]$	$[H_2]$	
1	0.0060	0.0010	1.80×10^{-4}
2	0.0060	0.0020	3.60×10^{-4}
3	0.0010	0.0060	0.30×10^{-4}
4	0.0020	0.0060	1.20×10^{-4}

(a) (i) Determine the order of reaction for each of the reactants, NO and H_2 from the data given and desribe your answer. [4 marks]

Order with respect to NO : .....

Order with respect to H_2 :.....

(ii) Write the overall rate law for the reaction. [1 mark]

.....

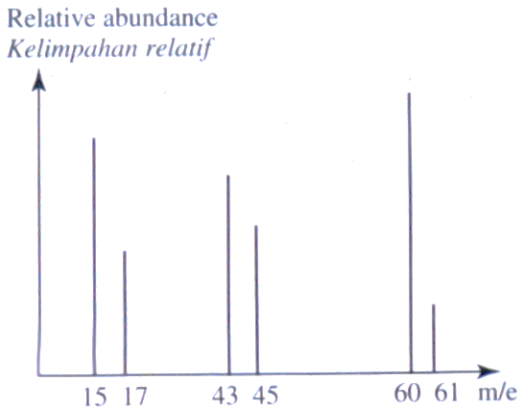
(b) Calculate the value of the rate constant, k for the reaction including the units.
[2 marks]

(c) For experiment 2, calculate the concentration of NO remaining when exactly one-half of the original amount of H_2 had been consumed.
[2 marks]

Section C *[30 marks]*

Answer any **two** questions in this section.

18 (a) The mass spectrum (not in scale) of an alcohol with the molecular formula of C_3H_8O is shown below.



(i) Give two possible ions that are responsible for each of the peaks with mass 43 and 45.
[4 marks]

(ii) Suggest the structural formula of the alcohol. Give a reason for your suggestion. [4 marks]

(iii) What species is responsible for the peak at mass 61 ? [1mark]

marks]

(iii) Based on the sketch in (a)(ii), explain what happens when the process of fractional distillation is carried out on a mixture of propan-1-ol and water that contains 50% of propan-1-ol by mass. *[7 marks]*

(b) State and explain what happens when solid silver chloride is shaken with aqueous potassium iodide. *[4 marks]*

[K_{sp} : AgCl = 1.0×10^{-10}; AgI = 9.0×10^{-17}]

ii. [1]

	2HI(g)	$H_2(g)$	$I_2(g)$
Initially(mol)	0	2	1
change	2x	-x	-x
At equilibrium(mol)	2x	2-x	1-x

[1]

$$K_c = \frac{[H_2][I_2]}{[HI]^2}$$

$(2-x)(1-x)/(2x)^2 = 2.0x10^{-2}$

$x = 0.739 \text{ mol dm}^{-3}$

[1]

[HI] at equilibrium = 2x

= 2(0.739)

= 1.5 mol dm^{-3} **(2sf)**

TOTAL MARKS	16
MAXIMUM	15

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