SAMPEL PERCUMA

Trial STPM 2022 Kimia Semester 1 Terengganu

Set penuh: Kertas Percubaan STPM

Sem 1 · Kimia

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JABATAN PENDIDIKAN NEGERI TERENGGANU

STPM 2022

PEPERIKSAAN PERCUBAAN
SEMESTER 1

CHEMISTRY

Nama :.....

Kelas :.....

DIBIAYAI OLEH KERAJAAN NEGERI TERENGGANU

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Section A [15 *marks*]

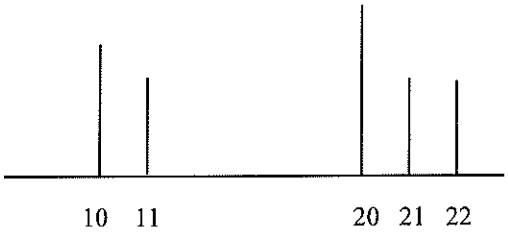
Answer **all** *questions.*

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

1 A sample of oxygen gas which contains atoms of two isotopes ^{16}O and ^{18}O is analysed in a mass spectrometer. Which of the ions below will be deflected most in the magnetic field?

A $^{16}O_2^+$
B $^{18}O_2^+$
C ^{16}O — $^{18}O^+$
D $^{16}O_2^{2+}$

2 The mass spectrum of a gaseous element is shown below.



Which of the following statements are true?

A The element is a diatomic gas.
B The element has 5 isotopes.
C The relative molecular mass is 20.
D The relative atomic mass is 10.

3 In which one of the following does ionic bonding occur between the named atoms?

A Aluminium and chlorine in the tetrachloroaluminate ion.
B Boron and fluorine in boron trifluoride.
C Hydrogen and chlorine in hydrogen chloride.
D Hydrogen and sodium in sodium hydride.

4 Which of the following pairs of substances have the same shape?

A CO_2 and SiO_2
B BeH_2 and H_2S
C BCl_3 and PCl_3
D CH_4 and $AlCl_4^-$

5 The covalent molecule of XY_n has the following properties.

i) polar
ii) pyramidal in shape
iii) forms coordinate covalent bond with boron triflouride molecules.

Which of the following statements about XY_n molecule is **not** true?

A The element X is more electronegative than element Y.
B The element X is located in Group 15 of Periodic Table.
C X atom undergoes sp^3 hybridisation to form bonds with Y atom.
D XY_n molecule can act as a Lewis acid.

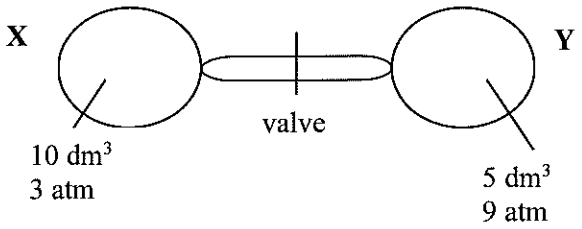
6 What is the approximate value of the O — C — O bond angle in the ethanoic acid?

A 90°
B 109°
C 120°
D 180°

7 Which of the following statements describes a phenomenon which can be explained by intermolecular hydrogen bonding?

A The melting points of the Group 1 hydroxides increase with increasing relative molecular mass.
B The boiling points of the alkanes increase with increasing relative molecular mass.
C Ice has a lower density than water at 0 °C.
D Hydrogen chloride forms an acidic solution when dissolved in water.

8



The above diagram shows two vessels each containing gas X and Y respectively at temperature T. If gases X and Y do not react with one another, what is the equilibrium pressure at temperature T when the valve is opened?

A 3 atm
B 4 atm
C 5 atm
D 6 atm

9 Which of the following substance is expected to have the highest critical temperature?

A H_2
B He
C CH_4
D CBr_4

14 What is the pH of the solution obtained when 300 cm^3 of 2.0 mol dm^{-3} sulphuric acid is added to 200 cm^3 of 0.4 mol dm^{-3} aqueous potassium hydroxide?

A 1.10
B 6.88
C 9.51
D 12.60

15 The Ag^+ concentration in a saturated solution of argentum ethanedioate, $Ag_2C_2O_4$, is 2.3×10^{-4} mol dm^{-3} at 298 K. What is the solubility product, K_{sp} of argentum ethanedioate at the same temperature?

A 2.3×10^{-4} mol dm^{-3}
B 5.3×10^{-8} mol^2 dm^{-6}
C 6.1×10^{-12} mol^3 dm^{-9}
D 1.2×10^{-11} mol^3 dm^{-9}

Section B [15 marks]

*Answer **all** questions in this section.*

Write the answers in the space provided.

16. (a) State the Le Chatelier's Principle. [1]

.....

.....

(b) Equilibrium I:

$$H_2O(g) + C(s) \rightleftharpoons H_2(g) + CO(g) \qquad \Delta H = +131 \text{ kJ mol}^{-1}$$

Equilibrium II:

$$2CrO_4^-(aq) + 2H^+(aq) \rightleftharpoons Cr_2O_7^{2-}(aq) + H_2O(l)$$

Use the Le Chatelier's principle to predict and explain the effect of

(i) increasing pressure in Equilibrium I [1]

.....

.....

(ii) increasing temperature in Equilibrium I [1]

.....

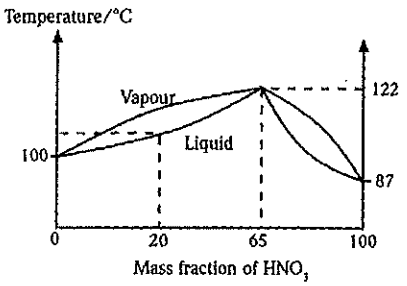
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(iii) increasing concentration of H^+ ions in Equilibrium II [1]

.....

.....

(c)



From the graph, nitric acid (boiling point = 87 °C) and water form an azeotropic mixture that boils at 122 °C and has a composition of 65% nitric acid by mass.

(b) By referring to the graph above, explain the changes of temperature and composition of the mixture in the distillation flask when a mixture of nitric acid and water is distilled. The percentage of nitric acid in the flask is 20% by mass. [3]

Section C [30 marks]

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

*You 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 a new page of the answer sheet.*

18 (a) (i) State the energy level transitions of an electron that can produce the Lyman series in an emission spectrum of the hydrogen atom and give three characteristics of the series. [4]

(ii) Discuss the application of Aufbau principle in the electronic configuration of an element Q which is in Group 9 and Period 4 in the Periodic Table. [3]

(b) An ammonia molecule accepts one hydrogen ion to form an ammonium ion or loses one hydrogen ion to form an amide ion. Draw the Lewis structures of ammonium and amide ions. Compare the shapes of the two ions. [8]

19 (a) Explain the following observation.

(i) Graphite can conduct electricity whereas diamonds are not electric conductors. [3]

(ii) The melting points of sulphur and silicon dioxide are 95.6 °C and 1850 °C respectively. [3]

(b) Two closed flasks of volume 5.0 dm^3 contain 0.64 mol of oxygen gas and 0.29 mol of nitrogen gas. The temperature is fixed at 25 °C. Calculate the partial pressure of nitrogen gas in the flask in the system when the valve is opened and left to reach equilibrium. [6]

(c) Sketch a graph of pV/RT against p for 1.0 mol of ammonia gas at 0 °C. Based on the graph, explain the negative deviation of ammonia gas compared to an ideal gas. [3]

20 (a) Define rate law for a chemical reaction. [2]

(b) Cyclopropane decomposes into propene through the ring opening of cyclopropane according to the equation:

$$C_3H_6(g) \rightarrow CH_2=CHCH_3(g)$$

The rate constant for the decomposition is 15.12 s^{-1} at 400 °C.

(i) What is meant by rate constant? [1]

(ii) Write the rate equation for the decomposition of cyclopropane. [1]

(iii) Calculate the half-life of cyclopropane. [2]

(iv) If 1.0 mol of cyclopropane is introduced into a 1 dm^3 container, what is the concentration of cyclopropane at 400 °C after two half-lives? [1]

SECTION A [15 MARKS]

Question No.	Answer	Question No.	Answer
1	D	9	D
2	A	10	B
3	D	11	C
4	D	12	B
5	D	13	C
6	C	14	A
7	C	15	C
8	C		

SECTION B [15 MARKS]

Question No.	Suggested Answer	Marks
16 (a) (i)	* Le Chatelier's principle states that * if a system in equilibrium undergoes a change / disturbed the system will oppose or reduce the change in order to achieve equilibrium again.	1
16 (b) (i)	*Number of moles of gas on the left = 1.* *Number of moles of gas on the right = 2.* Increasing the pressure will cause the equilibrium position move to the left, because the forward reaction involves an increase in the number of moles of gas.	1
16 (b) (ii)	Thus heating will cause the equilibrium position to move to the right, because the reaction to the right is endothermic.	1
16 (b) (iii)	Equilibrium will shift to the right because more CrO^{-}_{4} ions react with H^{+} ions to produce $Cr_2O_7^{2-}$ and H_2O. **Thus the concentration of H ions can be reduced.**	1
16 (c)	*By referring to the graph in (a), the mixture of nitric acid and water in the distillation flask will boil at a temperature higher than 100 °C.* The temperature in the distillation flask will rise during distillation. *The composition of the mixture in the distillation flask will also change.* The composition of nitric acid will increase from 20 % to 65 %. When the mixture in the distillation flask becomes 65 % nitric acid, it becomes an azeotropic mixture that boils at 122 °C.	1 1 1
	TOTAL	**7**
17 (a)	Acid is a chemical substance that can donate protons, H^{+} ion.	1
17 (b) (i)	$NH_4^{+} + OH^{-} \longrightarrow NH_3 + H_2O$	1
17 (b) (ii)	NH_4^{+} ion donates a proton to OH^{-}, thus it acts as a Brønsted-Lowry acid. The OH- ion receives a proton from NH_4^{+}, thus it reacts as a Brønsted-Lowry base.	1 1
17 (c) (i)	From the graph, at 110 kPa pressure, the mole fraction of hexane 0.32	1
17 (c) (ii)	Total vapour pressure = 96 kPa	1
17 (c) (iii)	The mole fraction of hexane = 0.8 hexane = 0.8 x 90 kPa = 72 kPa	1

TAMAT SAMPEL

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