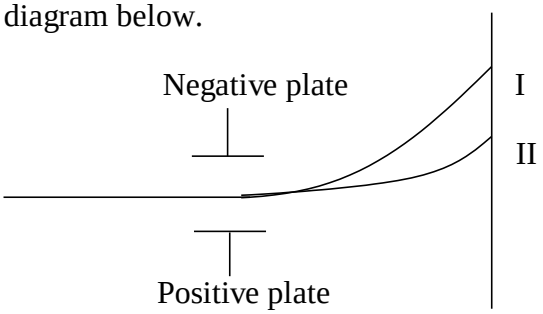
1. A beam of particles is passed through a electric field. The effect of the electric field on the beam is shown in the diagram below.



Which particle is defelcted at position II

A n B $^{2}D^{+}$

C e D $^{1}H^{+}$

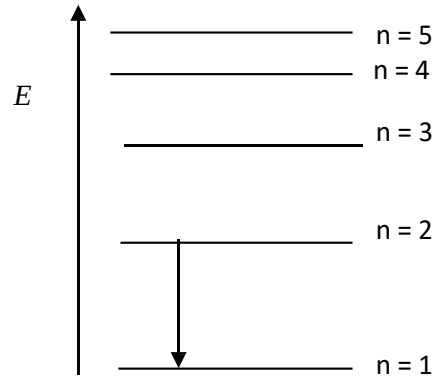
2. Boron has two isotopes with relative isotopic masses of 10 and 11. When 1.00g of boron reacts completely with hydrogen, 1.278 g boron hydride, B_2H_6 is formed. Which ratio of ^{10}B to ^{11}B is correct?

A 3:2 B 4:1

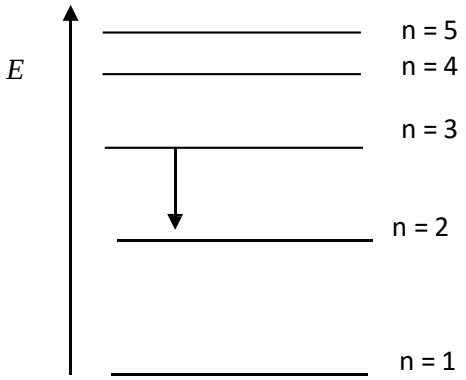
C 2:3 D 1:4

3 Transition of electrons between energy levels in an atom will cause an absorption or emission of light. Which energy level diagram shows the transition of electrons that emits light with the shortest wavelength?

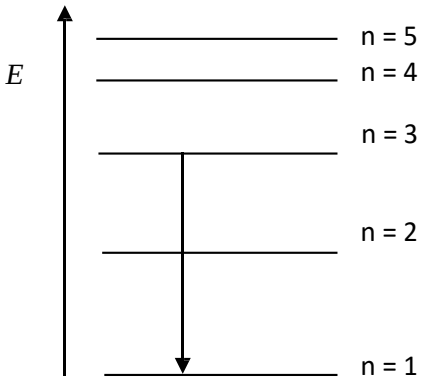
A



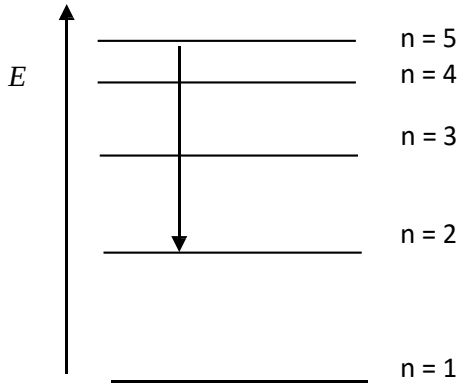
B



C



D



4 An atom of element Z has nucleon number 55 and thirty fundamental uncharged particles in its nucleus. What is the valence electronic configuration of a Z^{2+} ion?

A $3d^{10}4s^2$ B $3d^4 4s^1$

C $3d^3 4s^2$ D $3d^5$

5 The ionic radii of four ions are as follows:

Ion	Ionic radius/nm
P^+	0.095
Q^{2+}	0.031
R^-	0.136
S^-	0.126

Which ionic compound has bonding with the greatest covalent character?

A *PR* B QR_2 C QS_2 D *PS*

6 The boiling point of CH_2OH and CH_2SH are 64.5 ºC and 5.8 ºC respectively. What is the cause of the difference in the boiling point?

A Oxygen more electronegative than sulphur

B The O – H bond is stronger than S – H bond

C Molecular size of CH_2SH is bigger than CH_2OH

D The van der Waals forces in CH_2OH is stronger than CH_2SH

7 Fullerenes and graphite are allotropes of carbon. Which statements is not true about both allotropes?

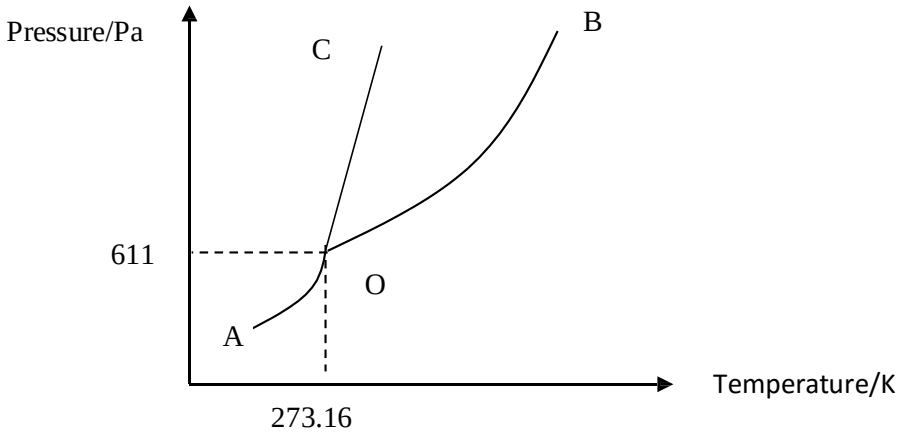
A Both contains delocalized electron and conduct electricity.

B Both have van der Waals forces exist in the molecules.

C Both using the same types of carbon hybridisation.

D Both are soft and slippery.

8 A phase diagram of substance X is shown below



What can be deduced from the phase diagram?

A *X* exist as liquid at a pressure of 611 Pa and a temperature of 298 K

B An increase in pressure will increase the freezing point of *X*

C An increase in pressure will decrease the boiling point of *X*

D *X* sublimes at a pressure higher than 611 Pa

9 The rate equation for the hydrolysis of CH_3COOCH_3 is shown below:

$$CH_3COOCH_3(l) + H_2O(l) ====== CH_3COOH(l) + CH_3OH(l)$$

The rate law for the hydrolysis in the presence of excess H_2O is rate = $k[CH_3COOCH_3]$.

Which condition will increase the value of *k*?

A. Increased in pressure

B. Increase temperature

C. Higher concentration of CH_3COOH

D. Higher concentration of CH_3COOCH_3

12 An equilibrium system is subjected to the following changes separately:

(i) Decreasing pressure at a constant temperature
(ii) Increasing temperature at a constant pressure

The equilibrium system whose reaction product will increase in quantity when subjected to the above changes is

A $2SO_2(g) + O_2(g) \text{ ====== } 2SO_3(g)$ ΔH = negative

B $N_2(g) + 3H_2(g) \text{ ===== } 2NH_3(g)$ ΔH = negative

C $H_2(g) + I_2(g) \text{ ====== } 2HI(g)$ ΔH = positive

D $CaCO_3(s) \text{ ====== } CaO(s) + CO_2(g)$ ΔH = positive

13 An aqueous solution of monobasic acid has a pH 3.5. A 25.00 cm^3 volume of an aqueous solution of the acid is completely neutralized by 27.50 cm^3 of a 0.10 mol dm^{-3} sodium hydroxide solution. The value of the dissociation constant of the acid is

A 3.16×10^{-4} mol dm^{-3}

B 3.48×10^{-5} mol dm^{-3}

C 9.08×10^{-7} mol dm^{-3}

D 9.99×10^{-8} mol dm^{-3}

14 When solid ammonium chloride is added in excess to an aqueous solution of ammonia containing phenolphthalein as an indicator

A. a buffer solution is formed

B. hydrogen chloride gas is evolved

C. the pink colour of the solution remains unchanged

D. a solution with a pH less than 7 is formed

15 The vapour pressure of pure liquids X and Y at 25ºC are 48 kPa and 36 kPa respectively. The total vapour pressure of a mixture of the two liwuids with 0.30 mole fraction of X at the same temperature is 39.6 kPa.

Which of the following statements ia true of the mixture?

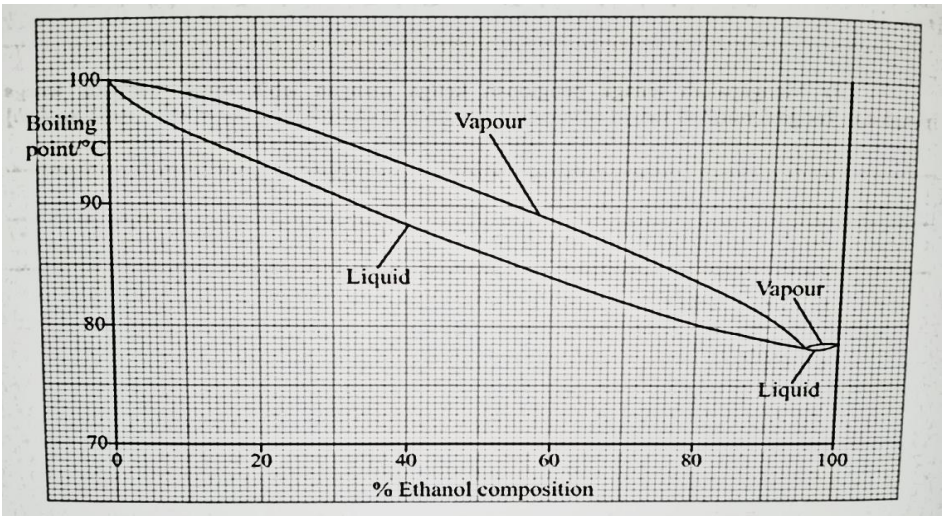
A The mixture shows a negative deviation from Raoult's law

B Fractional distillation of the mixture yields Y as the distillate.

C The vapour pressure of Y in the mixture at 25ºC is 10.8 kPa

D The strength of intermolecular forces of X and Y are about the same.

17 The boiling point composition curves for the mixture of ethanol and water at constant pressure is shown in the graph below.



(a) State the type of deviation from Raoult's law exhibited by the mixture of ethanol and water. [1]

…….....

(b) Explain why the mixture of ethanol and water shows that kind of deviation? [1]

……..

……..

(c) What is meant by azeotrope? [2]

……..

……..

……..

(d) From the above graph determine the vapour composition of the azeotrope at its boiling point and the vapour composition of the distillate when 50.0% ethanol solution is fractionally distilled twice. [2]

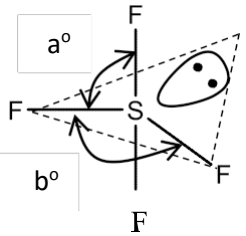
The vapour composition of azeotrope: ……

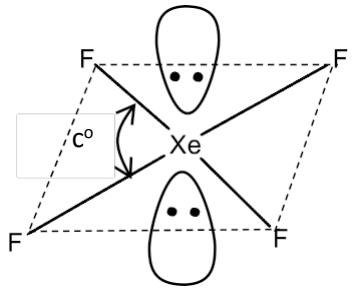
The vapour composition of distillate: …….

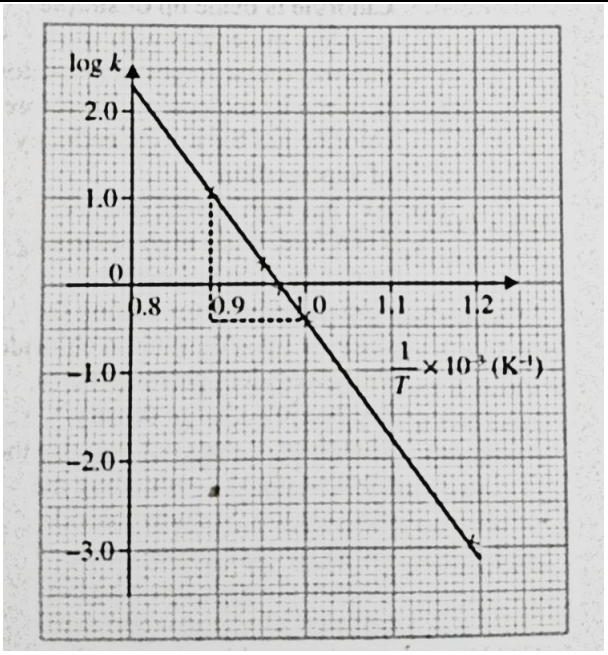
(e) State the physical method to obtain absolute ethanol from an azeotropic mixture of ethanol and water. [1]

……..

1(B)	2(D)	3(C)	4(D)	5(B)	6(A)	7(A)	8(B)	9(B)	10(A)
11(D)	12(D)	13(C)	14(A)	15(D)					

16	(a)	From PV = nRT, as V, R and T is constant at another condition, $P_1/n_1 = P_2/n_2$ no. of mol of He = 0.88 - 0.5 - 0.1 $100/1.0 = 88/n_2$ = 0.28 mol $n_2 = 0.88$ mol.		1 1
	(b)	(i)	$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$; with state	1
		(iii)	Excess $H_2 = 0.5 – 0.2 = 0.3$ mol	1
			$O_2 = 0$; He = 0.28 mol (both mention to get 1 mark)	1
	(c)	$P_1/n_1 = P_2/n_2$ $88/0.88 = P_2/0.28$ $P_2 = 28$ kPa . So partial pressure of He is 28 kPa.		 1
	(d)	$P_T = P_{He} + P_{water} + P_{hydrogen\ in\ excess}$ $P_T = 28 + 2.4 + 30 = 60.4$ kPa		1 1
		Total		8
17	(a)	Positive deviation		1
	(b)	Hydrogen bond between ethanol-ethanol molecules and water-water molecules only is stronger than ethanol-water molecules.		1
	(c)	Is the mixture with constant boiling point. Both the liquid and the vapour mixtures have the same compositions / mixture cannot be separated by fractional distillation		1 1
	(d)	*The vapour composition of azeotrope:* (95.0 – 96.0)% ethanol, (5.0 – 4.5) water. *The vapour composition of distillate*: 86.0% ethanol, 14.0% water. *ans in 1 d.p		1 1
	(e)	Add dehydrating agent, calcium oxide, CaO		1
		Total		7
18	(a)	*SF_4*  The repulsion between lone pair-lone pair is greater than lone pair-bond pair $a^o < 90^o$, $b > 90^o$ Shape = see-saw contains 4 bond pairs and one lone pair. Diagram (with lone pair electron at F atom)		1 1 1 1 1

		XeF_4  Diagram (with lone pair electron at F atom)	The repulsion between lone pair-lone pair is greater than lone pair-bond pair $c^o = 90^o$ Shape = square planar contains 4 bond pairs and two lone pairs electron.	1 1 1 1 1
	(b)	AlF_3 and AlI_3 AlF_3 are ionic compound while AlI_3 are covalent compound. Small size of F^- ion has lower polarisibility than I^- ion OR F atom is high electronegative than I atom. Small size and high charged/High charge density of Al^{3+} ion polarized the bigger size of I^- ion and forms covalent bond.		 1 1 1 1
	(c)	High melting point of HF because HF formed hydrogen bond between molecules. While HCl formed van der Waals forces between molecules. Hydrogen bond is stronger than van der Waals forces and requires more heat.		1 1 1
			Total	17
			Max	**15**
19	(a)	Log k =- $\frac{E}{2.303R}(\frac{1}{T})$ + log A $\frac{1}{T}$ x $10^{-3}(K^{-1})$ | log *k* 1.19 | -2.96 1.00 | -0.42 0.97 | -0.06 0.95 | 0.22 0.89 | 1.06		1 2

			 From the graph, gradient *m* $= -\frac{1.45}{0.11\ x\ 10^{-3}}$ $= -\frac{1.45}{0.11} \times 10^3$ $E_a = -m\ (2.303R) = (-\frac{1.45}{0.11} \times 10^3)(2.303 \times 8.314) = 252\ 394\ J = 252\ kJ\ mol^{-1}$ Unit *k* is s^{-1} so this is first order reaction.	3 1 1 1
	(b)	(i)	Heterogenous catalyst Example : $V_2O_3(s)$	1 1
		(ii)	Thre are 3 main steps in heterogenous catalyst. Step 1: Adsorption - SO_2 and O_2 molecules form temporary chemical bond with catalyst active sites. Step 2: Reaction - The neighbouring SO_2 and O_2 molecules form S – O bonds with one another, Step 3: Desorption - The complete SO_3 molecules break away from the catalyst's surface. - This leaves a free surface of catalyst for further reaction.	1 1 1 1 1 1
			Total	17
			Max	**15**
20.	(a)	Buffer solution is a solution that its pH change very slightly when small amount of acid or alkali is added to it.		1
	(b)	By using excess $NH_3(aq)$ / limited $HCl(aq)$ buffer solution can be prepared. The buffer solution must contain a large amount of NH_3 molecules and its conjugate acid, NH_4^+ / NH_4Cl. Ammonia is a weak base dissociates partially in water according to the following equation. $NH_3(aq) + H_2O(l) \text{ ========== } NH_4^+(aq) + OH^-(aq)$ NH_3 reacts with HCl according to the following equation $NH_3(aq) + HCl(aq) \rightarrow NH_4Cl(aq)$	1 1 1 1

Suka sampel ini?

Kertas Percubaan STPM

Sem 1 · Kimia

- 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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