SAMPEL PERCUMA

Skema Modul g-CAKNA STPM 2023 Kimia Semester 1

Set penuh: Kertas Percubaan STPM

Sem 1 · Kimia

Sampel ini: 7 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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Sampel bermula di muka surat sebelah

Section B [*15 marks*]

Answer **all** *questions*.

Write the answers in the spaces provided.

16. a) Hypoflourous acid (HOF) is the only known molecules that contain element hydrogen , oxygen and fluorine.

i) Draw a Lewis dot diagram for HOF molecules. [1]

ii) Identify the molecular shape ,bond angle and type of hybridisation in HOF molecules. [3]

Molecular shape :----------

Bond angle :----------

Hybridisation :----------

iii) Determine the polarity of HOF molecules . Explain your answer. [3]

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iv) State one type of intermolecular force in HOF [1]

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) Part of the Lyman series of the emission spectrum of hydrogen atom are shown in the diagram below.



510.2 756.3

Wavelength, λ

Explain the formation of the emission spectrum above. [7]

(b) Explain how electron are filled in the orbitals of a fluorine atom by using Aufbau principle, Pauli exclusion principle and Hund's rule. [5]

(c) The proton number of copper, Cu is 29.

i) Write the electronic configuration for Cu^{+} and Cu^{2+}. [1]

ii) Based on the electronic configurations, which is more stable, Cu^{+} or Cu^{2+}. Explain your answer. [2]

19 (a)The decomposition of trichloroethanoic acid (CCI_3COOH) into carbon dioxide and trichloromethane follows a first order mechanism with a half-life of 3 hours at 80 ^{o}C.

(i) Write the rate equation for the decomposition of trichloroethanoic acid. [1]

(ii) Calculate the fraction of the trichloroethanoic acid remain acid after 12 hours. [2]

(b) In another reaction, A → B, the initial rate is $1.7x10^{-4}$ $moldm^{-3}s^{-1}$ when the concentration of A is 0.25 $moldm^{-3}$.

(i) Calculate the rate of reaction when the concentration of A is 0.75 $moldm^{-3}$ if the reaction is second order with respect to [A] [4]

ANSWER SET 1

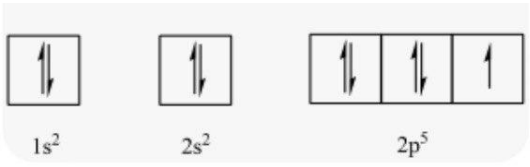
SECTION A [*15 marks*]

QN. NU	ANS	EXPLANATIONS
1	**C**	The size of an atom is not controlled by the nucleon number. We cannot predict whether an atom is radioactive or not from the proton number or nucleon number. The average of 28 and 30 is 29 if the composition of the isotopes is 1:1. Since the actual atomic mass is 28.1, which is less than 29, there should be more ^{28}Si atoms than ^{30}Si atoms. ^{30}Si has 2 more neutrons than ^{28}Si.
2	**C**	The difference between the two masses is 19. They cannot be isotopes. The difference in mass between isotopes is usually a few mass units only. If peak X is due to a dispositive ion, then its intensity should be very low. This is because it is more difficult to produce a dispositive ion as more energy is needed. The peak at m/e= 19 is caused by $^{19}M^+$ and the peak at 38 is caused by the molecular ion $^{19}M_2^+$. The relative atomic mass of the element is 19. 38 is the relative molecular mass of the element.
3	**C**	The Lyman series is in the ultra violet region. The convergent limit has the shortest wavelength (highest frequency). Lyman series is formed via the electronic transition from higher levels to n=1.
4	**A**	Z+N=A Z, Proton Number, is 8 Number of Proton same with number of electron in neutral atom that is 8 N, Neutron number is 10. So Species X has two electrons less than the number of neutron means 10 deducted 2 so balance is 8, so it is mean this species is neutral atom, so charge is 0.
5	**D**	Because the more lone pair available the smallest M-A-M bond angle will present.
6	**B**	If the overlapping of unhybridized orbital present in one molecule so π-bond will form.
7	**D**	CO_2 because produce 2 sigma C-O bonding pair and 2 π C-O bonding pair
8	**A**	Diamond and silicon (IV) oxide are giant molecular while iodine is simple molecular structure
9	**B**	The triple point of water is below 1 atm. The solid/liquid line has a negative slope.
10	**C**	Density ice = mass / volume Mass ice = density x volume = 1.00 g dm^{-3} x 0.001 dm^3 = 0.001 g Mol ice = mass / M = 0.001 / 18 = 5.55 x 10^{-5} mol

		Mole of steam = mole of ice = 5.55×10^{-5} mol PV = nRT (1) V = (5.55×10^{-5} mol) (0.0821 L atm $mol^{-1}K^{-1}$) (596 K) V = **2.72×10^{-3} dm^3**
11	**D**	The rate of equation is: Rate = k [reactant] 6.9×10^{-4} = k (0.30) k = 2.3×10^{-3} s^{-1} By using the expression; $t_{1/2}$ = ln 2 / k = 0.693 / 2.3×10^{-3} = 3.01×10^{2} s The rate-determining step of the reaction involves one species. (first order reaction) The rate equation does not provide information about the activation energy.
12	**C**	It is a zero order reaction. The acid is involved in the reaction.
13	**D**	The reaction is endothermic. Catalyst does not alter the equilibrium constant. The equilibrium constant increases as temperature increases. Decreasing pressure , the equilibrium shift to right (more moles is favoured) .So .the production of nitrogen increases.
14	**C**	$[H^+]$ acid = antilog (-3.5) =3.16×10^{-4} M Concentration of acid is using MaVa = MaVb a=b=1 So , Ma = $\frac{Mb\ Vb}{Va}$ = $\frac{0.10 \times 27.5}{25.0}$ = 0.11 mol dm^{-3} 2 By using $[H+]^2$ = Ka x c Ka = $\frac{(3.16 \times 10^{-4})^2}{0.11}$ = **9.08×10^{-7} mol dm^{-3}**
15	**D**	A mixture containing 40% of Y lies to the left of the azeotropic mixture. Hence, fractional distillation will produce pure Y followed by the azeotropic mixture. The boiling point shows a maximum; therefore the vapor pressure will show a minimum. The mixture shows negative deviation. A mixture of ethanol and methanol shows ideal behaviour. Liquid X boils at higher temperature. Thus, it is less volatile than liquid Y.

QUE	EXPLANATIONS	MARK
17	a) (i) $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ or	**1**
	$V_1 = \frac{(1.0)(1.80 \times 10^3)(480+273)}{(12.8)(27+273)}$	
	$= \mathbf{3.53 \times 10^2\ L}$	**1**
	(ii) $PV = nRT$	
	$PV = \frac{m}{Mr}RT$	
	$m = \frac{PVMr}{RT}$ (using R = 0.0821 L atm mol^{-1} K^{-1})	**1**
	$= \frac{(1.0)(3.53 \times 10^2)(16.0)}{(0.0821)(300)}$	**1**
	$= \mathbf{2.30 \times 10^2\ g}$	**1**
	Or (by using R = 8.31 m^3 Pa K^{-1} mol^{-1})	
	$= \frac{(101 \times 10^3)(3.53 \times 10^2 \times 10^{-3})(16.0)}{(8.31)(300)}$	
	$= \mathbf{2.30 \times 10^2\ g}$	
	(iii) There are attraction and repulsion force between CH_4 molecules.	**1**
	CH_4 molecules has volumes // The volume of the CH_4 gas is not negligible .	**1**
	Total marks	**7m**

SECTION C [*30 marks*]

QU. NU	EXPLANATIONS	MARK
18	a)	
	The electron in its ground state absorbs energy and	**1**
	electron becomes excited	**1**
	The electron emits energy in the form of electromagnetic radiation/ light/ photon when transits to a lower energy level	**1**
	Line are formed because the energy of electron are quantized	**1**
	Electron transition occurs from energy levels of $n > 1$ to $n = 1$	**1**
	The energy difference between 2 energy levels is given by ΔE and corresponds to the wavelength/ frequency	**1**
	The lines in the spectrum becomes convergent because the difference in energy levels becomes smaller	**1**
	b)	
	Aufbau Principle: orbitals with the lowest energy will fill up first	**1**
	Hund's Rule: The 2p orbitals of same energy / degenerate orbital, electrons are filled singly with parallel spin before pairing occurs.	**1**
	Pauli Exclusion Principle: An orbital contain maximum of two electron of opposite spin.	**1**
	Orbital diagram of F atom 	**1**
	Electronic configuration of F atom is $1s^2\ 2s^2\ 2p^5$	**1**
	c) i. Cu^+ : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$	
	or	**1**
	Cu^{2+}. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9$	
	ii. Cu^+ is more stable.	**1**
	completely filled ($3d^{10}$) orbitals has greater stability	**1**
	Total marks	**15 m**

QU. NU	EXPLANATIONS	MARK
19	(a) (i) rate = k[CCI_3COOH]	**1**
	(ii) There are 12/3 = 4 half life in 12 hours	**1**
	$1 \rightarrow 1/2 \rightarrow ¼ \rightarrow 1/8 \rightarrow 1/16$ or Therefore, the fraction of the trichloroethanoic acid remaining after 12 hours is **1/16**	**1**
	(b) (i) second reaction, rate = $k[A]^2$ or $1.7x\ 10^{-4} = k(0.25)^2$	**1**
	$k = 1.7x10^{-4} /(0.25)^2$ = **2.72×10^{-3} $M^{-1} s^{-1}$**	**1**
	When [A] = 0.75, rate = $k(0.75)^2$	**1**
	= $2.72\ x10^{-3} \times (0.75)^2$	**1**
	= **$1.53\ x10^{-3}$ mol $dm^{-3}s^{-1}$**	**1**
	c) (i) – Iron provide an alternative pathway with lower activation energy	**1**
	-More colliding hydrogen and nitrogen molecules will have energy equals or more than lowered activation energy	**1**
	- The frequency of effective collision increase	**1**
	- The rate of reaction increase	**1**
	(ii) – The hydrogen and nitrogen molecules are adsorbed (loosely bonded) to the surface of iron	**1**
	-This adsorption process weakens the H-H and N-N bonds making it easier to break	**1**
	- The new bonds are then formed between adjacent hydrogen and nitrogen molecules to form ammonia.	**1**
	- The products are then desorbs from the surface of the solid catalyst	**1**
	Total marks	**15m**

TAMAT SAMPEL

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