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KEMENTERIAN PENDIDIKAN MALAYSIA

PRE MATRICULATION PROGRAMME EXAMINATION

SEMESTER 1

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CHEMISTRY SK015

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JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

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This question paper is CONFIDENTIAL

TABLE OF RELATIVE ATOMIC MASSES

Element	Symbol	Proton number	Relative atomic mass
Aluminum	Al	13	27.0
Antimony	Sb	51	121.8
Argon	Ar	18	40.0
Arsenic	As	33	74.9
Barium	Ba	56	137.3
Beryllium	Be	4	9.0
Bismuth	Bi	83	209.0
Boron	B	5	10.8
Bromine	Br	35	79.9
Cadmium	Cd	48	112.4
Calcium	Ca	20	40.1
Carbon	C	6	12.0
Cerium	Ce	58	140.1
Cesium	Cs	55	132.9
Chlorine	Cl	17	35.5
Chromium	Cr	24	52.0
Cobalt	Co	27	58.9
Copper	Cu	29	63.6
Fluorine	F	9	19.0
Gold	Au	79	197.0
Helium	He	2	4.0
Hydrogen	H	1	1.0
Iodine	I	53	126.9
Iron	Fe	26	55.9
Krypton	Kr	36	83.8
Lead	Pb	82	207.2
Lithium	Li	3	6.9
Magnesium	Mg	12	24.3
Manganese	Mn	25	54.9
Mercury	Hg	80	200.6
Neon	Ne	10	20.2
Nickel	Ni	28	58.7
Nitrogen	N	7	14.0
Oxygen	O	8	16.0
Phosphorus	P	15	31.0
Platinum	Pt	78	195.1
Potassium	K	19	39.1
Protactinium	Pa	91	231.0
Radium	Ra	88	226.0
Radon	Rn	86	222.0
Rubidium	Rb	37	85.5
Scandium	Sc	21	45.0
Selenium	Se	34	79.0
Silicon	Si	14	28.1
Silver	Ag	47	107.9
Sodium	Na	11	23.0
Strontium	Sr	38	87.6
Sulfur	S	16	32.1
Tin	Sn	50	118.7
Tungsten	W	74	183.9
Uranium	U	92	238.0
Zinc	Zn	30	65.4

LIST OF SELECTED CONSTANT VALUES

Avogadro's number , N_A	*= 6.02 x 10^{23} mol^{-1}*
Molar volume of gases , V_m	*= 22.4 dm^3 mol^{-1} at STP*
	= 24 dm^3 mol^{-1} at room temperature
Molar of gases constant , R	*= 8.314 J K^{-1} mol^{-1}*
	= 0.08206 L atm mol^{-1} K^{-1}
Density of water , ρ	*= 1 g cm^{-3}*
Pressure , P	*1 atm = 760 mmHg = 760 torr = 101.325 kPa*
	= 101325 Nm^{-2}

Answer ALL the questions.

1 (a) A 0.94 L bottle of vinegar contains 5% (v/v) of ethanoic acid. What volume of ethanoic acid does the bottle of vinegar contain? 3M

(b) The following redox reaction occurs in an acidic condition.

$$MnO_4^- + Sn^{2+} \longrightarrow Mn^{2+} + Sn^{4+}$$

(i) Write the half-reactions for the redox reaction. 2M
(ii) Balance the redox equation using the ion-electron method. 1M

(c) An amount of 1.6 g zinc reacts with 230 ml of 1.00 $molL^{-1}$ hydrochloric acid solutions to produce zinc chloride, $ZnCl_2$ and hydrogen gas.

(i) Write a balanced chemical equation for the reaction. 1M
(ii) Determine the limiting reactant in the reaction. 6M
(iii) Calculate the amount (in grams) of $ZnCl_2$ obtained. 4M
(iv) Calculate the volume of hydrogen gas produced at STP. 4M

2 (a) A hydrogen atom produces a blue line with a wavelength of 486.4 nm.
(i) Calculate the frequency of this line. 1M
(ii) Determine the electron transition associated with this line. 3M
(iii) Name the series of the line spectrum in which this line is found. 1M

(b) X is an element with proton number of 21.
(i) Write the electronic configuration of X atom. 1M
(ii) Give the sets of quantum numbers for the valence electrons in the X atom. 3M
(iii) Draw a shape of orbital occupied by the highest principal quantum number in X atom. 1M
(iv) Write the orbital diagram of the most stable ion for X 1M

3 a)

There are three possible resonance structures for the laughing gas nitrous oxide, **N_2O**.

(i) Draw all the possible structures of gas nitrous oxide 3M
(ii) Assign the formal charge for each atom in all the resonance structures. 3M
(iii) Which is the most plausible structure? Explain your answer. 2M

b)

The **NF_3** molecule is used for plasma etching in a semiconductor fabrication process.

(i) Draw the Lewis structure for NF_3 1M

(ii) State its molecular geometry. 1M

(iii) State type of hybrid 1M

(iv) Determine the polarity of the molecule and reason 2M

c)

Aluminium and magnesium are metals.

(i) Explain the formation of metallic bonds in magnesium using the electron sea model. 2M

(ii) Why aluminium has a higher boiling point than magnesium. 2M

4 (a) At 30 ^{0}C and 745 mmHg, a sample of gas with 10.50 g occupied a volume 8.00 L.

(i) State the conditions at which a gas approach the ideal behaviour. 2M
(ii) Calculate the molar mass of the gas above. 2M
(iii) Based on kinetic molecular theory of gases, give one assumption made in the ideal gas equation. 1M

(b) Based on Table below:

Table

Compound	Boiling point (K)
BH_3	173
NH_3	240
PH_3	185

(i) Define vapour pressure and boiling point. 2M
(ii) State the relationship between vapour pressure and boiling point. 1M
(iii) Arrange the compounds in order of decreasing strength of intermolecular forces. 1M

5 (a) Nitrogen(IV) dioxide dimerised as follows, 7M

$2NO_{2(g)} \rightleftharpoons N_2O_{4(g)}$ $\Delta H = -58.84$ kJ

At 100°C, the value of K_c is 5.0. Calculate K_p for the above reaction. If initially 1 mole of NO_2 is filled into a 1 L vessel, determine the concentration of N_2O_4 at equilibrium

(b) *The equilibrium between dinitrogen tetraoxide (colourless) and nitrogen dioxide (dark brown) is represented by the equation below:* 2M

$N_2O_4(g) \rightleftharpoons 2NO_2(g)$ $\Delta H = +58$ kJ

Explain the effect (if any) of the following changes on the K_p and amount of nitrogen dioxide in the equilibrium mixture if Helium gas is added at constant pressure.

6 (a) A 0.10 mol dm^{-3} iodic acid, HIO_3 solution has a pH of 1.16. Calculate the degree of dissociation of the iodic acid 6M

(b) In an experiment, 21.5 mL of 0.5 M HCl was titrated against 0.5 M N_2H_4 solution. The end point is reached when 21.5 ml of N_2H_4 solution was added according the equation below.

$HCl\ (aq) + N_2H_4\ (aq) \rightarrow N_2H_5Cl\ (aq)$

(i) Predict the pH of the solution at the end point. 3M

(ii) State the suitable indicator for this titration. 1M

(c) Solid AgCl is placed in a beaker of water. After some time, the Ag^+ ion and Cl^- ion concentration are measured and found to be 1.0×10^{-6} M. Does precipitate form in this situation? 4M

[K_{sp} AgCl = 1.0×10^{-10}]