



Maris Stella College - Thimbirigaskatuwa

Grade 12 (2027 AL)

2nd Term Evaluation

May - 2026

Chemistry

02

E

I

Three hours

Name : Class : Class No:

Plank constant $= 6.626 \times 10^{-34} \text{ J s}$

Avogadro constant $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$

Velocity of light $c = 3 \times 10^8 \text{ m s}^{-1}$

- This paper contains 7 pages. Write the answers on this paper.

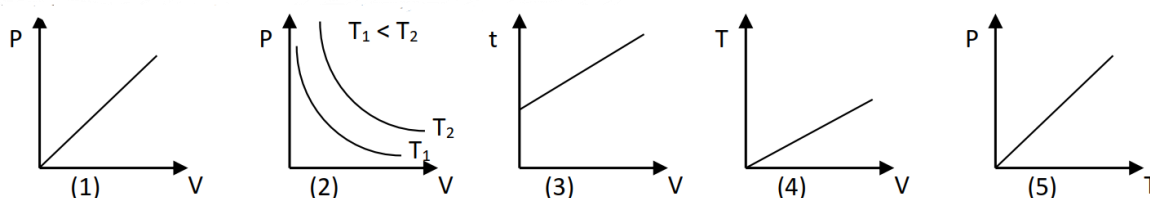
- Select the correct pair,
 - E. Rutherford – Gold foil experiment
 - J. J. Thomson – Nuclear model
 - R. Millikan – Cathode ray tube
 - Henry Becquerel – discovery of Radium
 - F.W. Aston - Charge of electron
- The number of electrons in the manganese atom (Mn, $Z=25$) that have quantum numbers $l=0$ and $m_l = -1$ respectively are,
 - 6 and 4
 - 8 and 12
 - 8 and 5
 - 8 and 6
 - 10 and 5
- M** is an element that belongs to the second period in the Periodic Table. It forms a covalent molecule **MCl₃** which has a dipole moment. The group of the periodic Table to which **M** belongs is,
 - 2
 - 13
 - 14
 - 15
 - 16
- The number of **unstable** Lewis dot-dash structures that can be drawn for the peroxyntic acid molecule (formula HNO_4 ,) is,

$$\text{H}-\ddot{\text{O}}-\ddot{\text{O}}-\overset{\text{:O:}}{\underset{\oplus}{\text{N}}}-\ddot{\text{O}}:^-$$

 - 1
 - 2
 - 3
 - 4
 - 5
- An organic compound containing C, H and O only, has 29.6% oxygen by mass. Its relative molecular mass is 270. How many oxygen atoms are present in a molecule of this organic compound? (H=1, C=12, O=16)
 - 1
 - 2
 - 3
 - 4
 - 5
- How many moles of hydrogen atoms are present in 100 g of a solution of ethanol in water containing 10%(m/m) ethanol solution? (H=1, C=12, O=16)
 - 1.3
 - 10.0
 - 11.3
 - 5.2
 - 5.7

- 7) In which of the following pairs is the electron pair geometry around the central atom not the same?
- OF_2 , H_2Se
 - SO_4^{2-} , NH_3
 - ICl_3 , PCl_3
 - CO_2 , NO_2^+
 - XeF_2 , XeOF_2
- 8) Green light of wave length $4.42 \times 10^{-7} \text{ m}$ is observed in the emission spectrum of hydrogen. The energy of one photon of this green light is,
- $4.5 \times 10^{-19} \text{ kJ}$
 - $2 \times 10^{-19} \text{ kJ}$
 - $1.5 \times 10^{-19} \text{ kJ}$
 - $4.5 \times 10^{-22} \text{ kJ}$
 - $19.9 \times 10^{-26} \text{ kJ}$
- 9) The number of moles of KMnO_4 that are required to react completely with one mole of $\text{Fe}(\text{NO}_2)_2$ in acidic medium is, (Note: Neglect the loss of NO_2^- due to acidic conditions.)
- $\frac{3}{5}$
 - $\frac{4}{5}$
 - 1
 - $\frac{5}{4}$
 - $\frac{5}{3}$
- 10) Select the species with zero dipole moment,
- BeClBr
 - SO_2
 - SF_4
 - ICl_4^-
 - ClF_3
- 11) Which pair of the following has unpaired electrons?
- SO_2 and NO
 - NO and CO
 - NO and NO_2
 - NO_2 and N_2O
 - NO_2 and CO_2
- 12) Number of unpaired electrons in Cr^{3+} ion,
- 3
 - 5
 - 6
 - 4
 - 1
- 13) What is the maximum number of orbitals possible for the principal quantum number $n = 4$ and azimuthal quantum number $l = 3$?
- 6
 - 7
 - 5
 - 4
 - 14
- 14) What is the IUPAC name of FeC_2O_4 ?
- iron(II) carbonate
 - iron carbonate
 - iron(II) dicarbontetroxide
 - iron(III) oxalate
 - iron(II) oxalate
- 15) What is the **false** statement regarding ozone?
- Ozone is a linear molecule
 - The two bond lengths of ozone are identical.
 - $\text{O} - \text{O} - \text{O}$ bond angle of ozone is smaller than 120° .
 - The central atom of ozone is sp^2 hybridized.
 - All oxygen atoms of ozone molecule are in the same plane.
- 16) A 100 cm^3 volume of a gaseous hydrocarbon is completely burnt produce a mixture of gases. When this mixture cooled to the room temperature, the volume reduced by 300 cm^3 . Then the remaining mixture was sent through a KOH solution and the volume reduced by 300 cm^3 too. What would be the formula of this hydrocarbon?
- C_2H_4
 - C_4H_{10}
 - C_3H_8
 - C_2H_6
 - C_3H_6
- 17) The concentration of Cl^- ions in a solution made by mixing 25 cm^3 of $0.1 \text{ mol dm}^{-3} \text{ BaCl}_2$ in ppm is, (1 ppm = 1 mg dm^{-3} , $\text{Cl} = 35.5$)
- 7100
 - 236.7
 - 710
 - 4733.3
 - 2367
- 18) What is the root mean square speed of N_2 gas at 77°C ($N=14$)
- $5.58 \times 10^2 \text{ m s}^{-1}$
 - $3.21 \times 10^2 \text{ m s}^{-1}$
 - $1.77 \times 10^1 \text{ m s}^{-1}$
 - $7.89 \times 10^2 \text{ m s}^{-1}$
 - $3.12 \times 10^5 \text{ m s}^{-1}$
- 19) A certain vessel contains 1 mol of Ar gas at a 27°C and $1 \times 10^5 \text{ Pa}$. In another identical container, under twice the pressure and 3 times the absolute temperature as in the first container, Krypton gas is kept the amount of Kr in the second vessel is,
- 0.67 mol
 - 1.0 mol
 - 2.0 mol
 - 1.5 mol
 - 3.0 mol

20) What is the correct graph according to Boyle's law?



➤ **Instructions for the questions from 21-25**

➤ For each of the question four responses (a), (b), (c) and (d) are given of which one or more is/are correct. Select the correct response/responses. In accordance with the instructions given on your answer sheet mark,

1. If only (a) and (b) are correct
2. If only (b) and (c) are correct
3. If only (c) and (d) are correct
4. If only (d) and (a) are correct
5. If any other number or combination of response is/are correct

Summary of above instructions				
(1)	(2)	(3)	(4)	(5)
Only (a) and (b) correct	Only (b) and (c) correct	Only (c) and (d) correct	Only (d) and (a) correct	Any other number or combination of response correct

21) What is/are the **correct** statement(s) for Na_2O_2 ?

- (a) Valency of sodium in this compound is 2
- (b) Na_2O_2 is produced when sodium metal reacts with excess oxygen gas
- (c) Oxidation number of oxygen in this compound is -1
- (d) Oxidation number of oxygen in this compound is -2

22) At the temperature 277 K, 18 g of glucose is dissolved in 180 g of water. Molar mass of glucose and water are 180 g mol^{-1} and 18 g mol^{-1} . Density of water at 277 K is 1.0 g cm^{-3} . What is/are the **correct** statement(s)?

- (a) Concentration of glucose in the solution is 0.56 mol dm^{-3}
- (b) Mass fraction of glucose in the solution is 0.10
- (c) Molality (number of moles in 1 kg of the solvent) of the solution is 0.1 mol kg^{-1}
- (d) Mole fraction of glucose in the solution is 1/101

23) What is/are **correct** statement/s?

- (a) I_2 is more soluble in aqueous KI than in pure water
- (b) KI reduces the polarity of water making non-polar I_2 more soluble
- (c) The solubility of a non-polar substance in a polar solvent is zero
- (d) Intermolecular forces between a non-polar molecule and a polar molecule are weaker compared to dipole-dipole interactions

24) Select the molecule/s which is/are containing all covalent, ionic and dative bonds.

- (a) NaNO_2
- (b) NaNO_3
- (c) $(\text{NH}_4)_2\text{CO}_3$
- (d) NH_3BF_3

25) Which of the following statement/s are **false**?

- (a) Along a period from left to right effective nuclear charge increase
- (b) Along a period from left to right shielding effect increase
- (c) Down in a group shielding effect always decrease
- (d) The effective nuclear charge is always smaller than the nuclear charge

➤ **Instruction for the questions from 26-30**

- From the table given below, select the response out of the responses (1), (2), (3), (4) and (5) that best fits the two statements given for each of the questions and mark appropriately on your answer sheet.

Response	First statement	Second statement
(1)	True	True and correctly explains the first statement
(2)	True	True but does not explain the first statement correctly
(3)	True	False
(4)	False	True
(5)	False	False

First statement	Second statement
26. Among the elements in periodic table, Chlorine has highest first electron gain energy	The valence shell electron configuration of chlorine is $3s^2 3p^5$
27. All the resonance structures of the carbonate ion contribute equally to the resonance hybrid	All the C – O bonds of carbonic acid are similar
28. BeCO_3 has higher boiling point than BaCO_3	When the cation size increase, polarizing power increase
29. The radius of the H atom is equal to the radius of the He^+ ion	Both H atom and He^+ ion have 1 electron each
30. All the molecules in an ideal gas move at the same speed	There are no intermolecular attractive forces in an ideal gas

Periodic Table / ආවර්තික වගුව

1																	2
H																	He
3	4											5	6	7	8	9	10
Li	Be											B	C	N	O	F	Ne
11	12											13	14	15	16	17	18
Na	Mg											Al	Si	P	S	Cl	Ar
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
55	56	La	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
87	88	Ac	104	105	106	107	108	109	110	111	112	113					
Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub	Uut	...				

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Grade 12 (2026) - Chemistry

Name : Class : Class No:

Part 2

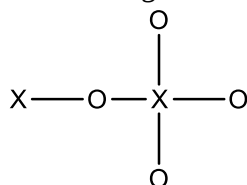
Answer **all** the questions

(1) (a) Write the following species in **ascending** order of the property mentioned in the brackets.

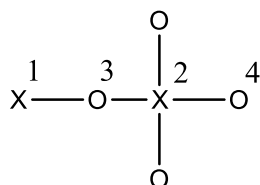
- (i) Cl, F, Na (electron gain energy)
- (ii) Cl^- , Ar, K^+ (radius of the species)
- (iii) C_2H_2 , C_2H_4 , C_2H_6 (electronegativity of Carbon atom)
- (iv) H_2O , H_2S , PH_3 (bond length)
- (v) B, Be, Ba (First ionization energy)

(b) (i) X is an element with 17 protons. Draw the most acceptable Lewis dot-dash structure for the molecule X_2O_4 .

Skeleton is given below.



(ii) Give the oxidation states of the two X atoms in the structure drawn in (i) above.



$\text{X}^1 = \dots\dots\dots$

$\text{X}^2 = \dots\dots\dots$

(iii) Based on the most stable Lewis structure in (i) above complete the table. (Numbering as of (ii))

	X^1	X^2	O^3	O^4
VSEPR units around the atom				
Electron pair geometry around the atom				
Shape around the atom	-----			-----
Hybridization of the atom				

(C) Consider the following information.

- The atoms H and F combine to form a heterodiatomic molecule AB that has a sigma bond. This is represented as H-F.
- The electronegativity value of H = 2.1 and F = 4.0
- The inter-nuclear distance between H and F atoms (d_{H-F}) of the AB molecule is given by the following equation.

$$D_{H-F} = r_H + r_F - c(X_F - X_H)$$

r = atomic radius, $c = 9$ pm (d and r are also measured in Pico metres (pm)).

Based on the above information, answer the following questions.

- (i) What is the name used to identify the type of sigma bond between H and F?

.....

- (ii) Show how fractional charges (δ^+ and δ^-) are located in the molecule HF.

- (iii) Write the equation to calculate the dipole moment (μ) of molecule HF and show its direction.

- (iv) Calculate the percentage of ionic character of the H-F bond in the HF molecule using the data given below.

Inter-nuclear distance (d_{H-H}) = 74 pm and (d_{F-F}) = 144 pm

Dipole moment of HF = 6.0×10^{-30} C m

Charge of an electron = 1.6×10^{-19} C

(2) (a) Element **P** is a metal in the fourth period. It forms the most abundant hydroxide in ash, and this ash was used by ancient people when making soap. Metal **P** forms a purple colour compound with permanganate ion which release oxygen gas when heated.

Element **Q** is a non-metal which release highest energy when gaining an electron. It shows highest oxidation number of +7. It forms most abundant salt in sea water.

(i) Identify the two elements P Q

(ii) Write the ground state electronic configuration of P and Q.

P

Q

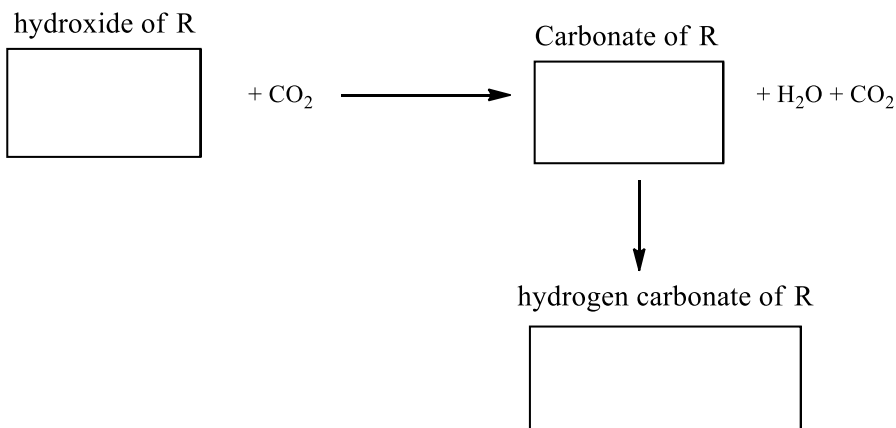
(iii) Write the chemical formula of the compound formed by **P** and **Q**

(iv) An aqueous solution of the hydroxide of P is used to absorb carbon dioxide gas in the experiments. Write the balanced chemical equation for this reaction.

(v) **R** is an element having one more proton than **P**. Identify the element **R**.

(vi) Write the ground state electronic configuration of **R**

(vii) The hydroxide formed by **R** also react with carbon dioxide gas and then the solution turns milky. When excess CO_2 is sent through this solution, it again becomes colourless. Write the balanced chemical equations for this reaction.



(b) (I) Write the ground state electronic configuration of following species,

(i) Ti^{2+}

(iv) Fe^{3+}

(ii) Cr

(v) Fe^{2+}

(iii) Cu

(II) Explain why Fe^{3+} ion is more stable than Fe^{2+} ion in air.

.....

Essay type Questions

Select two questions and answer in a separate paper (15 marks for each question)

- (03) (a) (i) In an agrochemical active ingredient following elements and their percentages were measured.
C = 21.3%, H = 4.73%, N = 8.28 %, O = 47.34 %, P = 18.34%
If the molar mass of this compounds is less than 200 g mol^{-1} , deduce the chemical formula of this compound.
- (ii) This chemical is available as 40%(m/m) solution in the market. Calculate the mass of water in 5 L of this agrochemical
- (iii) In some countries Arsenic was found in ground water above the toxic levels. If there is Arsenic more than 35 ppb in ground water, it is considered as not safe to drink. Ground water is used to produce that 5 L agrochemical solution. Calculate the maximum mass of Arsenic which can be present in 5 L of ground water. (As = 75)
- (iv) In the presence of aqueous NaOH and Al metal, sodium nitrate reduced to ammonia. In here aluminium metal oxide and form AlO_2^- .
- Write the oxidation and reduction half reactions
 - Write the balanced ionic equation
 - Write the balanced chemical equation
- (b) Zinc phosphide is used as a rodenticide (a chemical to kill rats). When it reacts with hydrochloric acid in the stomach it releases phosphine (PH_3) which is a highly toxic gas. (Zn=65, P=31, Cl=35.5)
- $$\text{Zn}_3\text{P}_2 + \text{HCl} \rightarrow \text{ZnCl}_2 + \text{PH}_3$$
- Write the balanced chemical equation for the above reaction.
 - Calculate the moles of PH_3 gas can be produced by 2.57 g Zn_3P_2 by reacting with excess HCl.
 - Draw the Lewis structure of PH_3 molecule.
 - Compare the boiling points of PH_3 and NH_3 and explain the reason for the difference.
- (04) (a)
- Compare three differences between ideal gas and real gas.
 - Write the Boyles' law in words.
 - Derive the Boyles' law using ideal gas equation
 - Nitrogen gas is filled to a vehicle tire with a volume of 10 dm^3 . If the pressure of the tire is $2.5 \times 10^5 \text{ Pa}$ at 27°C temperature, Calculate the number of moles of nitrogen filled into the tire. State any assumptions you made during calculation. (consider $8.314 \times 3 \approx 25$)
- (b)
- Write the balanced chemical equations for three chemical reactions of producing oxygen gas in the school laboratory. (These reactions should not produce any other gases)
 - A setup was prepared to collect oxygen gas in the laboratory. If the atmospheric pressure is $104\,240 \text{ Pa}$ and the saturated vapour pressure of water at 30°C is $4.24 \times 10^3 \text{ Pa}$, calculate the partial pressure of oxygen gas collected in the gas jar at 30°C . (density of water = 1000 kg m^{-3})
 - Calculate the number of moles of oxygen gas produced at 30°C
 - Calculate the mass of potassium permanganate reacted (K=39, Mn=55, O=16)
- V= 250 cm³
- (05) A student designed an experiment to calculate the concentration of Ca^{2+} ions in drinking water. A 100.0 cm^3 volume of drinking water was reacted with excess sodium oxalate ($\text{Na}_2\text{C}_2\text{O}_4$). Then the formed calcium oxalate (CaC_2O_4) crystals were filtered out and the residue was reacted with 0.01 mol dm^{-3} potassium permanganate solution. Diluted H_2SO_4 was used to acidify the medium and Mn^{2+} was used as a catalyst. 10.00 cm^3 of KMnO_4 was required to complete the reaction. (H=1, C=12, O=16, Ca=40, K=39, Mn=55)
- Write the balanced ionic / chemical equations for the following reactions.
 - Between calcium ions and sodium oxalate.
 - Between calcium oxalate and potassium permanganate in the presence of dil. H_2SO_4
 - Calculate the concentration of Ca^{2+} ions in water.