

General Certificate of Education (Adv. Level) Examination, 2025

Chemistry -I

One hour and 15 minutes

Instructions:

- * *This question paper consists of 08 pages.*
- * *Answer all questions.*
- * *The use of calculators is not allowed.*
- * *Write your examination number in the space provided on the answer script.*
- * *Carefully follow the other instructions provided on the back of the answer script.*
- * *For each question from 1 to 50, select the correct or most appropriate answer from the choices (1), (2), (3), (4), or (5) and mark it with a cross (X) as instructed on the back of the answer script.*

Name:

Universal gas constant: $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$

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

Avogadro Constant, $N_a = 6.022 \times 10^{23} \text{ mol}^{-1}$

Speed of light: $c = 3 \times 10^8 \text{ ms}^{-1}$

1.) The two scientists who discovered the cause or phenomenon that led to the following observations were,

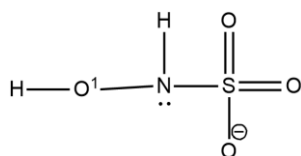
- (I) Red fluorescence appearing in perforated cathode ray tube.
 (II) Electromagnetic radiation is quantized.

- (1) William Crookes and Louis de Broglie (2) Goldstein and Max Planck
 (3) William Crookes and Max Planck (4) Goldstein and Henry Becquerel
 (5) Thomson and Henry Becquerel

2.) Which of these substances has the strongest forces between its molecules?

- (1) CH_3F (2) CH_4 (3) HCHO (4) H_2O_2 (5) CH_3OH

3.) The answer that correctly shows the shape around the atoms O¹, N and S of the ion;



- | | |
|---|---|
| (1) linear, trigonal planar, tetrahedral | (2) tetrahedral, trigonal planar, tetrahedral |
| (3) tetrahedral, tetrahedral, tetrahedral | (4) angular, pyramidal, tetrahedral |
| (5) angular, trigonal planar, tetrahedral | |

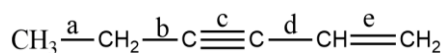
4.) Which of the following sets of quantum numbers describes the easily removable electrons of a neutral gaseous Fe atom?

- | | |
|--|---|
| (1) $n=3, l=2, m_l=0, m_s=+\frac{1}{2}$ | (2) $n=4, l=0, m_l=0, m_s=+\frac{1}{2}$ |
| (3) $n=3, l=2, m_l=-1, m_s=-\frac{1}{2}$ | (4) $n=2, l=1, m_l=0, m_s=+\frac{1}{2}$ |
| (5) $n=4, l=0, m_l=1, m_s=-\frac{1}{2}$ | |

5.) Which of the following statements is most **correct** regarding bonds?

- (1) Sigma (σ) bonds formed by lateral overlapping are more stable than pi (π) bonds.
- (2) A sigma (σ) bond or a pi (π) bond can be formed by overlapping *s* and *p* orbitals.
- (3) pi (π) bonds are formed only by lateral overlapping of two unhybridized dumbbell-shaped 2*p* orbitals.
- (4) Axes of the two *p* orbitals that participate in forming a pi (π) bond are parallel to each other, while they are perpendicular to the axes of the *p* orbitals that involve in forming the second pi (π) bond.
- (5) As axes of two hybridized orbitals are located along one axis, they can undergo both linear and lateral overlapping.

6.) Which answer depicts the increasing order of bond length of the bonds named **a, b, c, d** and **e** of the molecule,

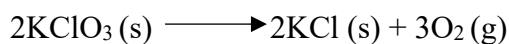


- | | | |
|-------------------------|-------------------------|-------------------------|
| (1) $a < b < d < e < c$ | (2) $c < e < d < a < b$ | (3) $c < d < e < b < a$ |
| (4) $c < e < d < b < a$ | (5) $d < c < e < b < a$ | |

7.) The oxygen volume percentage of normal air is 20 %. If the pressure is $1 \times 10^5 \text{ Nm}^{-2}$ and temperature is 27 °C of normal air, what would be the concentration of oxygen gas in it in mol dm^{-3} ?

- | | | | | |
|-------|-------|------------------------|------------------------|--------|
| (1) 8 | (2) 4 | (3) 8×10^{-1} | (4) 4×10^{-3} | (5) 40 |
|-------|-------|------------------------|------------------------|--------|

8.) When 12.25 g of potassium chlorite (KClO_3) decomposes according to the reaction:



What volume of oxygen gas (O_2) is produced at STP (0°C , 1 atm) ?

(Given: Molar mass of $\text{KClO}_3 = 122.5 \text{ g mol}^{-1}$; Molar volume at STP = 22.4 L mol^{-1})

- (1) 0.448 L (2) 0.896 L (3) 1.12 L (4) 3.36 L (5) 4.48 L

9.) The **correct increasing order** of bond angle is ?

- (1) $\text{XeF}_4 < \text{NO}_2 < \text{NO}_2^- < \text{NO}_3^-$ (2) $\text{XeF}_4 < \text{NO}_2^- < \text{NO}_2 < \text{NO}_3^-$
(3) $\text{XeF}_4 < \text{NO}_2^- < \text{NO}_3^- < \text{NO}_2$ (4) $\text{NO}_3^- < \text{NO}_2 < \text{NO}_2^- < \text{XeF}_4$
(5) $\text{NO}_2^- < \text{NO}_2 < \text{XeF}_4 < \text{NO}_3^-$

10.) A special property that occurs due to Hydrogen bonds is,

- (1) Decreasing of bond angle of H_2O than the bond angle of NH_3 .
(2) Increasing boiling points of HCl , HBr and HI in given order.
(3) Floating of ice on water.
(4) Having different boiling points for the isomers of C_5H_{12} .
(5) All the above.

11.) A mixture of NaCl and KCl has a total mass of 6.6 g. When treated with excess silver nitrate (AgNO_3), it produces 14.3 g of AgCl precipitate. Calculate the mass of NaCl in the mixture. Given that, Molar masses of $\text{Ag} = 108 \text{ g mol}^{-1}$, $\text{Na} = 23 \text{ g mol}^{-1}$, $\text{Cl} = 35 \text{ g mol}^{-1}$ and $\text{K} = 39 \text{ g mol}^{-1}$.

- (1) 2.90 g (2) 3.25 g (3) 4.10 g (4) 1.80 g (5) 5.56 g

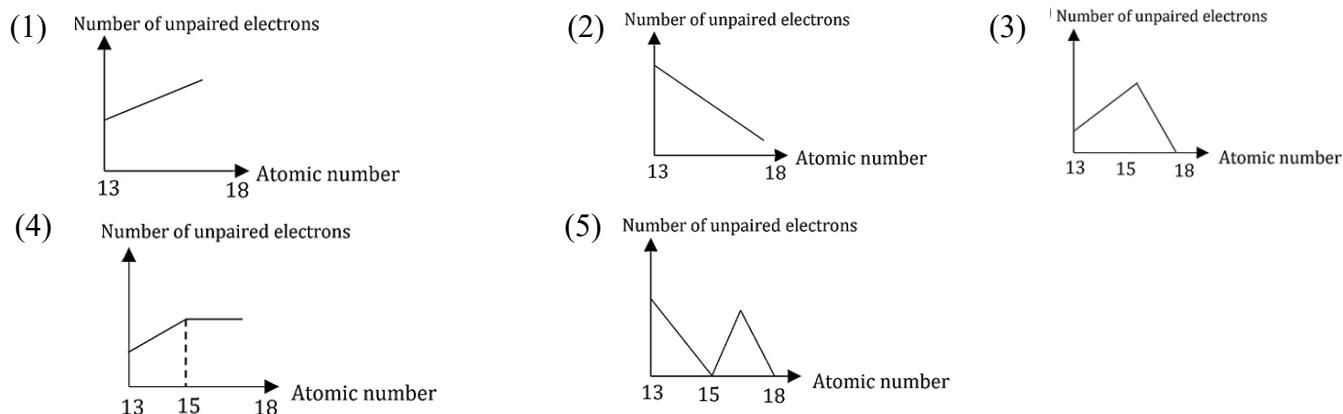
12.) Which of the following has the highest 4th ionization energy?

- (1) Al (2) Si (3) C (4) B (5) N

13.) Shapes of F_2O , H_3O^+ , and ClF_4^- are respectively,

- (1) Linear, Trigonal planar, Tetrahedral (2) Angular, Pyramidal, Square planar
(3) Angular, Trigonal planar, Square planar (4) Angular, Trigonal planar, Tetrahedral
(5) Linear, Pyramidal, Square planar

14.) Which of the following graphs depicts the variation of the number of unpaired electrons in the p sub energy level of elements with atomic numbers from 13 to 18?



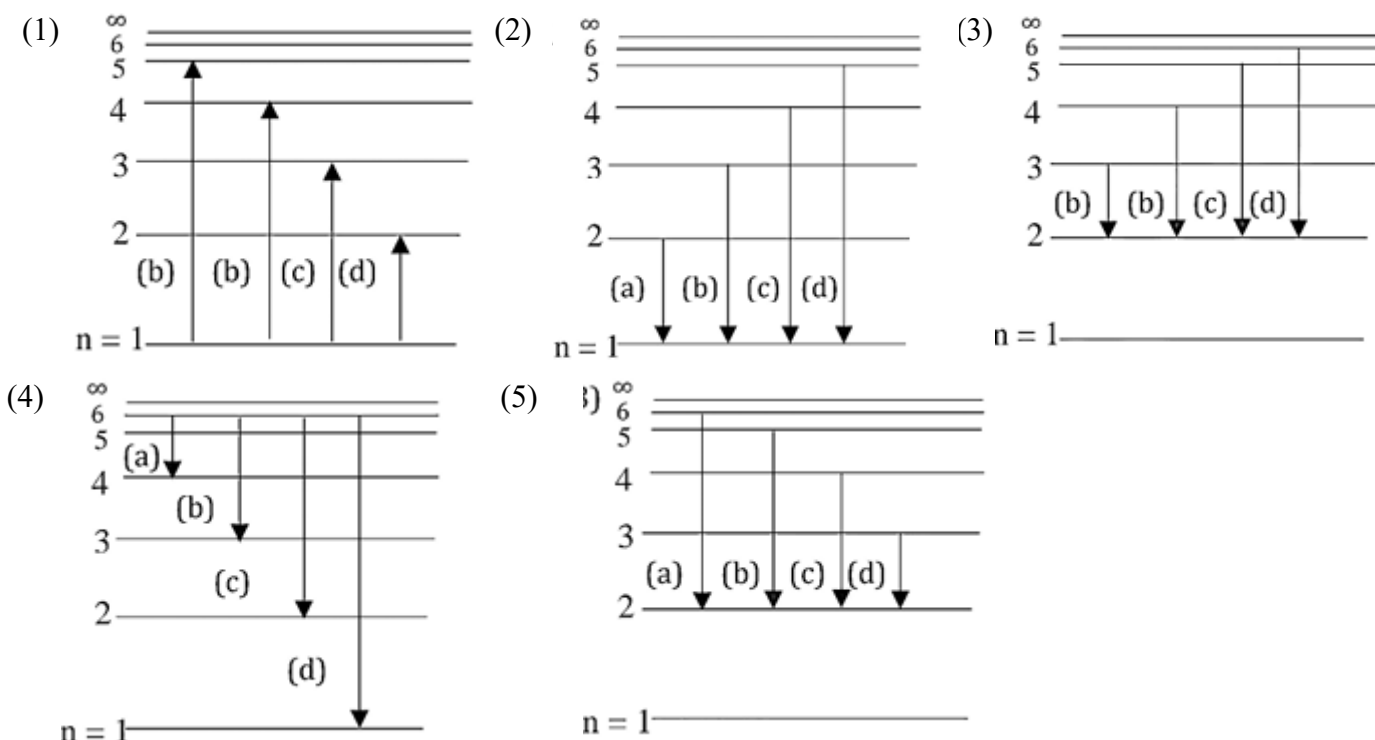
15.) A 150 W bulb emits radiation of $\lambda = 4500 \text{ \AA}$. 8.7% of this energy is emitted as light. What is the number of photons emitted by this bulb per second?

- (1) 2.8×10^{19} (2) 2.95×10^{19} (3) 1.98×10^{21} (4) 1.98×10^{20}
 (5) 2.80×10^{20}

16.) A part of the Hydrogen emission spectrum is given below. Note that these lines only belong to Balmer series.



Which of the following diagrams correctly depicts the electron transmission corresponding to above lines?



17.) **M** is an element belonging to the second period of the periodic table. It forms the covalent molecule **MCl₃** with a dipole moment. What is the group of element **M** in periodic table?

- (1) 2 (2) 13 (3) 14 (4) 15 (5) 16

18.) Which of the following quantum numbers will **not** be suitable for the blank?

Set of quantum numbers: {3, 2,, -1/2}

- (1) 3 (2) +2 (3) -2 (4) 0 (5) -1

19.) Which compound is least likely to have ionic bonding?

- (1) KI (2) BaO (3) SO₂ (4) SrCl₂ (5) Ca₃N₂

20.) The composition of Na⁺ ions in an aqueous solution of Na₂CO₃ is 368 ppm. What is the molarity of Na₂CO₃ (mol dm⁻³) ?.

- (1) 3.2×10^{-2} (2) 1.6×10^{-3} (3) 1.6×10^{-2} (4) 8×10^{-3} (5) None of these

* For question numbers 21 to 25 follow the instructions below.

Summary of instructions				
(1)	(2)	(3)	(4)	(5)
Only a) and (b) are correct.	Only (b) and (c) are correct.	Only (c) and (d) are correct.	Only (d) and (a) are correct.	Any other number or combination of responses is correct.

21.) Which of the following has similar hybridization around the central atom but different molecular geometry,

- (a) SF₄ (b) SO₄²⁻ (c) NH₃ (d) HCN

22.) Which of the following statements is/are **correct**?

- (a) Pure Hydrogen bonding can occur in molecules containing H–F, H–O, or H–N bonds, but it is strongest in H–F due to high electronegativity.
- (b) Oxidation number of oxygen in OF_2 is +2.
- (c) Cathode rays (electron beams) are deflected by electric and magnetic fields, but X-rays are not.
- (d) According to de Broglie's equation, if the kinetic energy of an electron increases, its wavelength decreases.

23.) $2\text{A}(\text{g}) + 3\text{B}(\text{g}) \longrightarrow \text{D}(\text{g}) + 2\text{E}(\text{g})$ Consider this reaction.,

An equal number of moles of A and B were added to a closed vessel. The reaction proceeded until one compound was completely consumed and 0.5 mol of the other compound remained. Which of the following statement **is/are** correct?

- (a) Remaining reactant was B.
- (b) Remaining reactant was A.
- (c) Initial system had 1.5 mol each from A and B.
- (d) Final system had 1.5 mol of E.

24.) The **structure/s** that obey octet rule **is/are**,

- (a) NO (b) O_3 (c) N_2O (d) AlCl_3

25.) 5.85 g of NaCl was dissolved in 500 cm^3 of water. Which of the following statements **is/are** correct regarding this solution? (Density of water 1 g cm^{-3})

[$\text{Cl} = 58.5\text{ g mol}^{-1}$, $\text{Na} = 23\text{ g mol}^{-1}$]

- (a) The molarity of the NaCl solution is 0.2 mol dm^{-3} .
- (b) The mass fraction of NaCl in the solution is 0.0115.
- (c) The mole fraction of NaCl in the solution is $1/501$.
- (d) The percentage by mass of NaCl in the solution is 1.15%.

* Follow the instructions below for questions 26 to 30.

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)	The dipole moment of NF_3 is larger than that of NH_3 .	Difference of electronegativity between N and F is approximately equal to that value between N and H.
27)	The solubility of $\text{Br}_2(l)$ increases when KBr is added.	Ion - induced dipole moment is formed in between Br_2 and Br^- .
28)	All ionic compounds dissolve completely in water.	A solution of water-soluble ionic compounds can conduct electricity.
29)	CaCO_3 decomposes at a lower temperature than SrCO_3 .	The polarizing effect of a cation increases with decreasing size and increasing charge.
30)	All molecules in an ideal gas move at same speed.	Only intermolecular repulsive forces are present in an ideal gas.

The Periodic Table

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	La-Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	Ac-Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lb	117 Ts	118 Og

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