

General instructions :

- All the questions are compulsory.
- Question numbers 1 to 5 are of 1 mark each.
- Question numbers 6 to 10 are of 2 marks each.
- Question numbers 11 to 22 are of 3 marks each.
- Question number 23 (a value based question) is of 4 marks.
- Question numbers 24 to 26 are of 5 marks each.
- Use of calculator is not allowed. Log tables would be provided if required for the calculations.

1. Refer to the following data and show that it obeys the law of constant composition:-

Experiment number	CuO formed	Cu present
1	2.19 g	1.75 g
2	1.83 g	1.46 g

2. a) In Hydrogen spectra name the spectral series obtained when an electron jumps from 2, 3, 4 energy level to the 1st energy level.
 b) In Balmer series the electrons jump from various higher energy levels to which lower energy level. (½,½)
3. State Modern periodic law. (1)
4. Give any two reasons for the elements to show anomalous behaviour. (1)
5. What is the difference between qualitative and quantitative analysis? (1)
6. Balance the following chemical reaction : -
 a) $\text{Mg}_3\text{N}_2 + \text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2 + \text{NH}_3$
 b) $\text{NaOH} + \text{Cl}_2 \rightarrow \text{NaClO}_3 + \text{NaCl} + \text{H}_2\text{O}$ (1,1)
7. a) What will happen to the frequency associated with a moving particle if its wavelength is increased to four times?
 b) How many neutrons are present in $^{64}_{29}\text{Cu}^+$?
 c) Filling up of 4s orbital takes place after 3p orbital. Why?
 d) Explain the term 'dual character'. (½x4)

(OR)

Calculate the energy of one mole of photons of radiations whose frequency is 5×10^{14} Hz ($N_A = 6.022 \times 10^{23}$) ($h = 6.625 \times 10^{-34}$ J Sec)

8. a) Show that the elements ${}^3\text{Li}^7$; ${}^{11}\text{Na}^{23}$; ${}^{19}\text{K}^{39}$ represent a triad.
 b) Give two drawbacks of Newland's law of octaves. (1,1)
9. a) Differentiate between sigma bond and pi bond (Two points only).
 b) Predict the formula of the compound formed between :-
 Silicon and Oxygen
 Lithium and Nitrogen.
 (At. number of Si = 14, O = 8, Li = 3, N = 7) (1,1)
10. Show the formation of N_2 molecule by : -
 a) Lewis dot structure method.
 b) Orbital overlap method. (at. No. of N=7) (1,1)
11. Answer the following questions:-
 a) Water is a liquid but hydrogen sulphide is a gas. Give reason.
 b) Dipole moment of CH_4 is equal to zero. What conclusion you can draw about its structure? What is the unit to express dipole moment?
 c) Explain hybridisation in PCl_5 molecule. (At. no. P=15, Cl=17)

(OR)

Answer the following questions:-

- a) Explain hybridisation in CH_4 molecule. (at. no. of C=6, H=1)
 b) Draw labelled energy level diagram to explain the formation of H_2 molecule.
 c) Draw two resonating structures of benzene molecule. (1,1,1)
12. A compound on analysis was found to contain potassium = 15.1%, Aluminium = 10.50%, Sulphur = 24.96%, Oxygen = 49.92%. Calculate the empirical formula of the compound. Also find the molecular formula if molecular mass of the compound is 258u. (At. mass of K=39u, Al=27u, S=32u, O=16u) (3)

13. a) Calculate the volume of oxygen liberated at NTP when 0.1 mole of potassium chlorate undergoes decomposition as per the following reaction : -

$$2 \text{KClO}_3 \rightarrow 2 \text{KCl} + 3 \text{O}_2$$
- b) From 0.2 g of carbon dioxide 10^{21} molecules are removed. How many molecules of carbon dioxide are left ? Given that molecular mass of carbon dioxide is 44u. (1,2)
14. a) A solution is prepared by dissolving 5g urea in 95g water. Calculate the mass percentage of urea in solution.
- b) Calculate the mole fraction of benzene in solution containing 30g benzene (molecular mass =78u) in 70g carbon tetrachloride (molecular mass=154u). (1,2)
- (OR)
- Calculate the molarity and molality of 40% of HCl (W/W). Density of the solution is 1.20 g/L. Given that molecular mass of HCl = 36.5u. (3)
15. a) Calculate wave number if the wavelength is 5800 \AA .
- b) What is the wave number of the light emitted when an electron in a hydrogen atom undergoes transition from an energy level with $n = 4$ to an energy level with $n = 2$. (Rydberg's constant = 109667 cm^{-1}) (1,2)
16. a) State Hund's rule of maximum multiplicity.
- b) Write the configuration of the following:- $_{28}\text{X}$; $_{19}\text{Y}^+$ (1,2)
17. If uncertainty in the measurement of position and momentum of an electron are found to be equal in magnitude, what is the uncertainty in the momentum of an electron. Uncertainty principle is not significant in day to day life why? ($h = 6.625 \times 10^{-34} \text{ J Sec}$) (3)
18. a) Assign group number and the period number for an element $_{16}\text{S}$.
- b) Write any two advantages of Mendeleev's periodic table.
- c) Position of hydrogen could not be justified in mendeleev's periodic table. Explain.
19. a) Define an isolated system.
- b) Predict in the following process entropy increases or decreases when :
 Egg \rightarrow Boiled egg.
- c) Calculate the enthalpy of formation of methane from the following data :
- | | | |
|---|--------------------------------------|---------------|
| $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ | $\Delta H = - 890.2 \text{ KJ/mole}$ | |
| $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ | $\Delta H = - 393.4 \text{ KJ/mole}$ | |
| $\text{H}_2 + \frac{1}{2}\text{O}_2 \rightarrow \text{H}_2\text{O}$ | $\Delta H = - 285.7 \text{ KJ/mole}$ | (1/2, 1/2, 2) |
20. Answer the following questions :
- a) Name the apparatus used to prepare H_2S gas in the laboratory.
- b) What is the colour of manganese salts?
- c) What is the group reagent for group 1 of cation analysis?
- d) For which cation Blue Lake test is performed as the confirmatory test?
- e) Pb^{++} belongs to which group of cation analysis?
- f) What is the flame colour of barium salts? (1/2x6)
21. Explain the procedure for performing the following :
- a) Flame test for cations belonging to group 5.
- b) Complete confirmatory test for Cl^{--} ; $\text{SO}_4^{-- --}$ (1,2)
22. Match the columns and rewrite the table :
- | Column A | Column B |
|-----------------------|--|
| a) NO_3^{--} | a) Blue colour |
| b) Cu^{++} | b) Group 6 |
| c) Group 4 | c) Nessler's reagent |
| d) Al^{3+} | d) Group 2 |
| e) NH_4^+ | e) Dil.HCl |
| f) SO_2 gas | f) $\text{NH}_4\text{Cl} + \text{NH}_4\text{OH}$ |
| | g) Pungent smell. |
| | h) Brown ring test |
| | i) Zn^{2+} |
23. As the number of vehicles is increasing, the demand for the motor fuel is increasing. The time is not far off when there may be acute shortage of crude petroleum and its products. LPG used as a domestic fuel is also a product of crude petroleum. Our government is helpless and has to increase the price of petroleum products. This will result in the increase in transportation of goods of our everyday life, and also the petrol expense to drive vehicles.

After reading the above paragraph answer the following questions :

- Name an alternative fuel which is used in the vehicles these days.
- In a vehicle, petrol or diesel is consumed. During the process heat energy is being converted to which type work.
- The problem of shortage of non renewable sources of energy has become very serious. What are the two suggestions which you can give as a citizen of India to deal with this problem? (4)

24.
 - Group 1 members are called alkali metals. Why?
 - Write general configuration of p-block elements.
 - What is the limitation if elements are classified into metals and non metals?
 - Arrange ${}_{10}\text{Ne}$, ${}_{8}\text{O}^{2-}$, ${}_{12}\text{Mg}^{2+}$, ${}_{11}\text{Na}^{+}$, ${}_{9}\text{F}^{-}$ in the increasing order of their radius.
 - Radius of anions is larger than the corresponding atom. Explain.
 - What are degenerate orbitals?
 - Why are lanthanoids and actinoids placed separately below the main table? (give one reason only)
 - What is the valency of noble gases?
 - Give any general property of d-block elements.
 - How is metallic character related to atomic radius? (1/2x10)

(OR)

- Which group members of the periodic table are called halogens?
- In the modern periodic table which groups accommodate p-block elements?
- Define electron gain enthalpy.
- Radius of anion is larger than the corresponding atom. Explain.
- First ionisation enthalpy of ${}_{11}\text{Na} < {}_{12}\text{Mg}$ but second ionisation enthalpy of $\text{Na} > \text{Mg}$. Explain.
- How many electrons can be accommodated in f-block elements?
- Name the only element which does not have any neutron in it.
- How many electrons are present in the first period of modern periodic table?
- Why are lanthanoids and actinoids placed separately below the main table? Give one reason only.
- How does valency vary within a period? (1/2x10)

25.
 - On the basis of Molecular theory write the configuration of N_2 molecule. (At.No. of N=7) Calculate its bond order. Predict its magnetic character.
 - Give any two limitations of valence bond theory.
 - Give any two conditions required for atomic orbitals to be able to overlap in order to form a molecular orbital. (1,2,2)

(OR)

- On the basis of Molecular orbital theory write the configuration of O_2 molecule. (At.No. of O=8) Calculate its bond order. Predict its magnetic character.
- Give any two conditions required for atomic orbital to be able to overlap in order to form molecular orbital.
- Explain the formation of NH_4^+ on the basis of Lewis dot structure method. (At. no. of N = 7, H = 1) (1,2,2)

26.
 - Define Hess's law.
 - Calculate the entropy change involved in the conversion of one mole (18g) of solid ice at 273 K to liquid water at the same temperature. Heat of fusion is 6025 J/mole.
 - Calculate the standard Gibb's free energy at 400 K for a reaction for which standard enthalpy change is 80 KJ /mole , and standard entropy change at this temperature is 120 J/K. Predict the feasibility of this reaction. Give reason for your answer. (1,2,2)

(OR)

- Enthalpy can not be the sole criteria to predict the feasibility of a reaction. Explain.
- Find the internal energy change for the reaction :

$$\text{H}_2\text{O}(l) \rightarrow \text{H}_2\text{O}(g)$$
at 373 K. Heat of vaporisation is 40.66 KJ /mole. $R = 8.3 \text{ j/mole/K}$.
- For the reaction at 298k $2A + B \rightarrow C$
 $\Delta H = 400 \text{ KJ mol}^{-1}$, $\Delta S = 0.2 \text{ K J K}^{-1} \text{ mol}^{-1}$. At what temperature will the reaction be in the state of equilibrium? (1,2,2)