Step Academy official

STUDENT NAME			CLASS	1st Year
PAPER CODE	98661		SUBJECT	Chemistry
TIME ALLOWED			TOTAL MARKS	
Paper Date			Paper Type	

Q1. **Choose the correct answer.**

1. The word atom comes from Greek language which means

(A) beautiful **(B)** Indivisible **(C)** smooth **(D)** sharp

2.
Leucippus is known to be the mentor of Democritus and the father of atomic philosophy.Who was the first to use the word atom?

(A) Leucippus **(B)** James Clerk Maxwell **(C)** Democritus **(D)** Erwin Schrodinger

3. Who put forward the atomic theory?

(A) Dalton **(B)** JC Maxwell **(C)** Al Ghazali **(D)** E Schrodinger

4.
Who observed the movement of molecules from one container to the other in Maxwell's thought experiment?

(A) Maxwell **(B)** the demon **(C)** Maxwell's students **(D)** Maxwell's mentor

5. The Maxwell's demon experiment violates which of the following law?

(A) law of conservation of mass **(B)** the Boyle's law **(C)** first law of thermodynamics **(D)** second law of thermodynamics

6.
The Schrodinger's thought experiment is believed to have contributed to evolving the well-known field of physics called

(A) plasma physics **(B)** particle physics **(C)** statistical mechanics **(D)** quantum mechanics

7. What were the findings for an outside observer in Schrodinger's cat thought experiment?

(A) the cat was dead **(B)** the cat was alive **(C)** the cat was both alive and dead simultaneously **(D)** the cat was neither alive nor dead

8.
The famous book of Al-Ghazali, "Tahafut-al-Falsafa" challenged the philosophical thought of Neoplatonic thinkers which believed that

(A) perfection and happiness are achievable in this world   **(B)** no happiness and perfection exist in this world   **(C)** there is life hereafter   **(D)** man is mortal

9. Al-Ghazali thought experiment was based on burning

(A) paper   **(B)** cotton   **(C)** wood   **(D)** coal

10. What is correct statement about Al-Ghazali's approach?

(A) he thought that every event must have a cause   **(B)** he thought that there is succession of events, not causation   **(C)** he thought that God can suspend the habitual continuation of events   **(D)** A. I & II only   B. II & III only   C. III only   D. I, II & III

11. What does the electron configuration $1s^2\ 2s^2\ 2p^4$ represent?

(A) Carbon   **(B)** Oxygen   **(C)** Neon   **(D)** Helium

12. Which subshell can hold a maximum of 10 electrons?

(A) s   **(B)** p   **(C)** d   **(D)** f

13. How many unpaired electrons are there in the electron configuration $3d^5$?

(A) 0   **(B)** 1   **(C)** 2   **(D)** 5

14. Which element has the electron configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^8$?

(A) Iron (Fe)   **(B)** Zinc (Zn)   **(C)** Nickel (Ni)   **(D)** Copper (Cu)

15. What is the electron configuration of a chlorine ion (Cl-)?

(A) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ **(B)** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$ **(C)** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^7$ **(D)** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^8$

16. Magnesium has how many Isotopes?

(A) 1   **(B)** 2   **(C)** 3   **(D)** 4

17. What is the basis on which molecular Ions are splitted in mass spectrometry?

(A) electric field   **(B)** magnetic field   **(C)** velocity of ions   **(D)** grid strength

18. Which orbital is sausage shaped?

(A) s   **(B)** p   **(C)** d   **(D)** f

19. Electrons tend to reside separately in the degenerate orbitals this is called:

(A) Auf Bau principle   **(B)** Pauli exclusion principle   **(C)** Hund's rule   **(D)** Fajan's rule

20. Which quantum number explain the splitting of orbitals in three dimensional space.

(A) principal quantum number   **(B)** azimuthal quantum number   **(C)** magnetic quantum number   **(D)** spin quantum number

21. Which of the following molecules is nonpolar?

(A) CCl_2F_2 **(B)** $CHCl_3$ **(C)** C_2Cl_4 **(D)** C_2H_5Cl

22. Which is the most likely shape of hydrazine, N_2H_4?

(A)   **(B)**   **(C)**   **(D)**
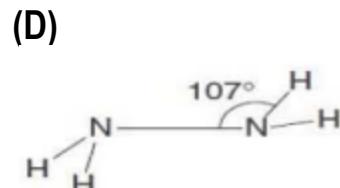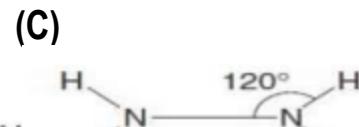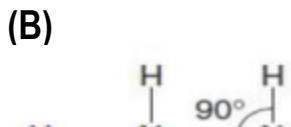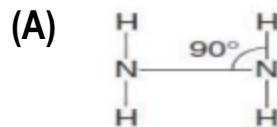
23. Which molecule contains only six bonding electrons?

(A) C_2H_4 **(B)** C_2F_6 **(C)** H_2O **(D)** NF_3

24. Which molecule is trigonal planar in shape?

(A) NF_3 **(B)** C_2Cl_4 **(C)** C_3H_6 **(D)** C_3H_8

**25.** Which of the following orbitals overlap with each other in the PH_3 molecule?

(A) sp^2-s   **(B)** sp-s   **(C)** sp^3-p   **(D)** sp^3-s

26. The diagram shows the variation of the boiling points of the hydrogen halides.
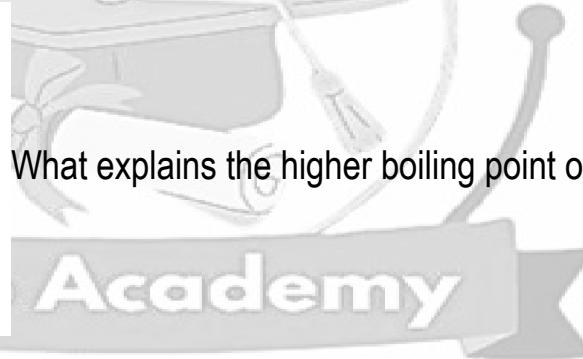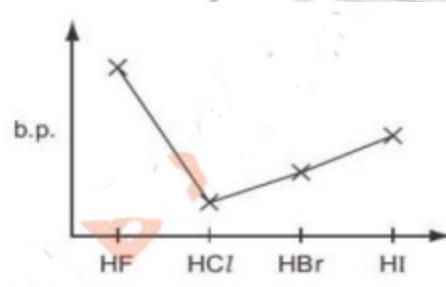
What explains the higher boiling point of hydrogen fluoride?

| **(A)**	**(B)**	**(C)**	**(D)**
The bond energy of HF molecules is greater than in other hydrogen halides.	The effect of nuclear shielding is much reduced in fluorine which polarizes the HF molecule.	The electronegativity of fluorine is much higher than for other elements in the group.	There is hydrogen bonding between HF molecules.

27. Which graph correctly describes a trend found in the halogen group?

(A)

bond length in X_2 (vs Cl_2, Br_2, I_2)

(B)

strength of van der Waals' forces (vs Cl_2, Br_2, I_2)

(C)

boiling point of X_2 (vs Cl_2, Br_2, I_2)

(D)

bond energy of HX (vs H-Cl H-Br H-I)
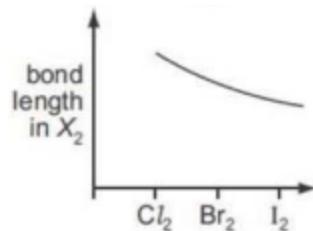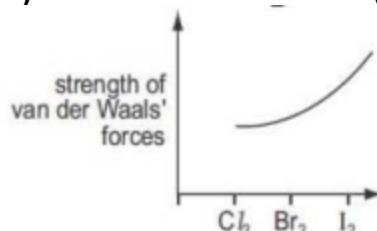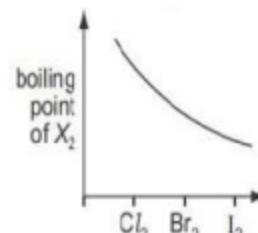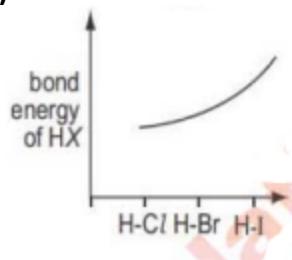
28. Sp^3 hybridization is not important in describing the bonding in;

(A) NH^{+4} **(B)** CCl_4 **(C)** H_2O **(D)** AgCl

29. In the formulation of N^{+2} from N_2, the electron is removed from;

(A) $\sigma 2p_x$ orbital   **(B)** $\sigma^* 2p_x$ orbital   **(C)** $\pi 2p_y$ orbital   **(D)** $\pi^* 2p_y$ orbital

30. In which process are hydrogen bonds broken?

(A) $H_2(l) \rightarrow H_2(g)$ **(B)** $NH_3(l) \rightarrow NH_3(g)$ **(C)** $2HI(g) \rightarrow H_2(g)$ **(D)** $CH_4(g) \rightarrow C_{(g)} +$

31. Which chlorine compound has bonding that can be described as Ionic with some covalent character?

(A) NaCl   **(B)** $MgCl_2$ **(C)** $AlCl_3$ **(D)** $SiCl_4$

32.
Gaseous nitrogen is less reactive than gaseous fluorine. What is the reason for this difference in reactivity?

(A)
The bolling point of nitrogen is lower than that of fluorine.

(B)
The relative molecular mass of nitrogen is lower than that of fluorine.

(C)
The atomic radius of nitrogen is greater than that of fluorine.

(D)
The bond strength in the molecule is greater in nitrogen than in fluorine.

33. Which sample produces most hydrogen by reaction with excess of HCl?

(A) 0.25mol Ca   **(B)** 0.25mol Al   **(C)** 0.25mol Zn   **(D)** 0.25 Na

34. A flask contains 500 cm³ of SO_2 at STP. The flask contains SO_2

(A) 40g   **(B)** 100g   **(C)** 50g   **(D)** 1.42g

35.
When 1 mole of each of the following is completely burnt in oxygen, which will give the greater mass of CO_2?

(A) CO   **(B)** Diamond   **(C)** Ethane   **(D)** Methane

36. 0.2 moles of Na_2SO_4, when completely ionized produce Na^+ ions.

(A) 2.4×10^{22} **(B)** 2.4×10^{23} **(C)** 1.204×10^{23} **(D)** 0.12×10^{23}

37. How much volume of NH_3 gas produced when 3g H_2 react with excess of N_2 at STP.

(A) 24 dm³   **(B)** 2.24dm³   **(C)** 2.4 dm³   **(D)** 1.2dm³

38. When equal volumes of SO_2 and O_2, taken for the formation of SO_3, which one will be Left unreacted.

(A) SO_2 **(B)** O_2 **(C)** Both   **(D)** Not possible

39. 0.1 moles of laughing gas (N_2O) consist of.

(A) 6.022×10^{22} molecules   **(B)** 1.806×10^{23} atoms   **(C)** 1.204×10^{23} atoms of N   **(D)** All

40. Which pair contains equal quantities?

(A) Volume of 28g N_2 and 8g CH_4 at STP   **(B)** Molecules in 0.1 mole NH_3 and 2.2414 dm³ O_2 at STP   **(C)** Mass of 1.204×10^{24} molecules of CO_2 and 4.8×10^{24} atoms of NH_3 **(D)** Bonds in 56g N_2 and 2 mole CH_4

41. $2X + 3y \longrightarrow 1Z$

(A) 25%   **(B)** 33.33%   **(C)** 66%   **(D)** 75%

42. Which one of the following forces are also called London forces?

(A) Ion-dipole forces   **(B)** Dipole-induced dipole forces   **(C)** Dipole-dipole forces   **(D)** Dispersion forces

43. Which of the following two halogens are gases at room temperature?

(A) Fluorine and Iodine   **(B)** Chlorine and Bromine   **(C)** Fluorine and Chlorine   **(D)** Iodine and Bromine

44. The scientist who discussed the phenomenon of viscosity are;

(A) Poisuelle   **(B)** Newton   **(C)** Fritz   **(D)** Vander Wall

45. The distillation under reduced pressure is called;

(A) Fractional distillation   **(B)** Vacuum distillation   **(C)** Steam distillation   **(D)** Pressure distillation

46. The unit of surface tension is;

(A) Newton per metre   **(B)** Newton per metre square   **(C)** 760mmHg   **(D)** Newton square per metre

47. The intermediate phase lying between the solid phase and the normal liquid phase is called;

(A) Crystalline solid   **(B)** liquid crystals   **(C)** Mesogens   **(D)** Crystal lattice

48. In which of the following are the particles the most disordered?

(A) Water at 100 °C   **(B)** Steam at 100 °C   **(C)** Impure water at 102 °C   **(D)** Water at 10 °C

49. Which of these statement best supports the idea that matter is made up of particles?

(A)	**(B)**	**(C)**	**(D)**
Liquids always fill the space available to them	Liquids are easily compressible	1 cm³ of water produces nearly 1700 cm³ of steam	If a bottle of perfume is opened, the smell spread quickly

50. Which of these processes involve a weakening of the attraction between particles?

(A) Condensation   **(B)** Freezing   **(C)** Crystallization   **(D)** Evaporation

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Q2.   **Write short answers of the following questions.**

1 . What was an atom to Democritus?

2 . How did Democritus connect atoms to feelings and properties of matter?

3 . How did Democritus connect atoms to feelings and properties of matter?

4 . How can we relate Schrodinger's cat experiment with quantum mechanics?

5 . Define theory of necessary causation. How did Al-Ghazali prove it?

6 . Define inductive and deductive reasoning.

7 . What is the importance of Bohr's Atomic model in modern atomic structure?

8 . Explain the charge and mass of fundamental sub-atomic particles.

9 . Explain the periodic trends of atomic radius with justification.

10 . How does shielding effect change the radius of an atom in a group from top to bottom?

11 . Why is the cation always smaller than the parent atom, and anion is bigger than the parent atom?

12 . Explain how does different spectral series originate in hydrogen spectrum?

13 .
Explain magnetic quantum number in detail. Why do s orbital have only one value of the magnetic quantum number?

14 . Why it is so that two electrons with same spin cannot reside in an orbital.?

15 . Why 3d orbital has greater energy than 45 orbital? Explain (n+1) rule.

16 .
Calculate the average atomic mass of magnesium keeping in view the relative abundance of its isotopes.

17 . What is effective nuclear charge?

18 .

What is the importance of electronic configuration in semiconductor materials?

19 . Why is there a large I.E gape between second and third values in Mg atoms?

20 .
49 g each of H_2SO_4 and H_3PO_4 have same number of molecules but having different number of atoms.

21 . Different gases having different masses occupy equal volume at STP.

22 . Limiting reactant is always in lesser quantity in reaction mixture or not.

23 .
Amount of product obtained through balance chemical equation is greater than the amount obtained experimentally.

24 . What are the basic assumption in Stoichiometric calculations?

25 . 18g of steam has Avogadro's No of molecules but 58.5g of NaCl has not.

26 . Give the general properties of liquids as to.(a) Diffusion(b) Compression

27 . What are the types of intermolecular forces, give examples?

28 . What is hydrogen bonding, give particular examples?

29 . What are the applications of H-bonding?

30 . What are the different types of physical properties of liquids?

31 . Define vapour pressure. What are the factors affecting the V.P?

32 . What is(a) Viscosity.(b) Surface tension.

33 . Define molar heat of fusion and molar heat of vaporization.

34 . How will you differentiate líquid crystals from pure liquids?

35 . Why distillation under reduced pressure is often used in the purification of chemicals?

Q3. **Write detailed answers of the following questions.**

1 . Explain thought experiment of J C Maxwell.

2 . Explain the experimental background of atomic theory.

3 . Describe what conclusions were drawn by Schrodinger from his thought experiment.

4 .
How did Al-Ghazali conclude from a piece of burning cotton? Also relate his conclusions with his concept of God involvement in all natural laws.

5 . Explain that Al-Ghazali's thought experiment was a challenge to inductive reasoning.

6 .

What is mass spectrometry explain its working and tell how the data is analysed?

7. Describe different rules adopted for electronic configuration of elements.

8. Explain ionization energy trends in the periodic table with justifications of these trends and anomalies.

9. Explore the impact of isotopes on atomic mass calculation.

10.
The table shows the atomic number and boiling points of some noble gases.

Gas	helium	neon	argon	krypton	Xenon
Atomic number	-12	-110	-118	-136	-154
Boiling point / °C	-253	-246	-186	-152	-107

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Explain this trend in both points. b Xenon forms a number of covalently bonded compounds with fluorine. 1 Draw a dot-and-cross diagram for xenon tetrafluoride, XeF_4.

iii Suggest a shape for XeF_4. Explain why you chose this shape.

12.
Aluminium chloride, $AICl_3$ and ammonia, NH_3, are both covalent molecules. A Draw a diagram of an ammonia molecule, showing its shape. Show any lone pairs of electrons. Also State the bond angle HNH in the ammonia molecule.

(b) What type of forces are present in ammonia molecule. Draw diagram to show forces between ammonia molecules.

(C) An ammonia molecule and an aluminium chloride molecule can join together by forming a co-ordinate bond. (1) Explain how a co-ordinate bond is formed. (2) Draw a dot-and-cross diagram to show the bonding in the compound formed between ammonia and Aluminium chloride, H_3NAICl_3

13. Electronegativity values can be used to predict the polarity of bonds.

(a) Explain the term electronegativity.

(b) The electronegativity values for some atoms are given below: H=2.1, C=2.5, F= 4.0, Cl=3.0, L= 2.5 Use these values to predict the polarity of each of the following bonds by copying the bonded atoms shown below and adding $\delta+$ or $\delta-$ above each atom.

i H—I (c) Describe the shape of this ICl3molecule. Also mention bond angle in it.

ii F—I (d) The boiling points of the hydrogen halides are shown in the table.

iii C—Cl

Hydrogen halide	HF	HCl	HBr	HI
Boiling point / °C	+20	−85	−67	−35

(1) Explain the trend in boiling points from HCl to HI.

(2) Explain why the boiling point of HF is so much higher than the boiling point of HCl.

(e) Tetrachloromethane, CCl_4, is a non-polar molecule. Draw a diagram to show the shape of this molecule. Explain why this molecule is non-polar.

14 .
(a) Hydrogen sulphide, H_2S, is a covalent compound. Explain the type of hybridization also write bond angle in HSH. Also show on your diagram the partial charges on each atom as $\delta+$ or $\delta-$ and an arrow showing the exact direction of the dipole in the molecule as a whole.

(b) Oxygen, O, sulphur, S, and selenium, Se, are in the same group in the Periodic Table.

(1) Explain why hydrogen selenide, H_2Se, has a higher boiling point than hydrogen sulphide, H_2S.

(2) Explain why the boiling point of water is so much higher than the boiling point of hydrogen sulphide.

15 . (a) Describe the shape of the carbon dioxide molecule.

(b) Bromine is a liquid at room temperature. Weak van der Waals' forces hold the bromine molecules together. Describe how van der Waals' forces arise.

16 . Water is extensively hydrogen bonded. This gives it anomalous (peculiar) properties.

(a) Explain why ice is less dense than liquid water. Also State two other anomalous properties of water.

(b) Propanone has the structure shown below.

$$CH_3$$
$$C=O$$
$$CH_3$$
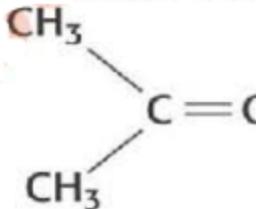
When propanone dissolves in water, it forms a hydrogen bond with water. Draw a diagram to show a propanone molecule and a water molecule forming a hydrogen bond.

(C) =1 ;Propanone has a double bond. One of the bonds is a σ bond (sigma bond). The other is a π bond (pi bond). Explain the difference between a σ bond and a π band in terms of how they are formed.

2; Copy the diagram, then complete it to show the shapes of the electron clouds in the σ bond and the π bond between the carbon atoms in ethene. Label your diagram.
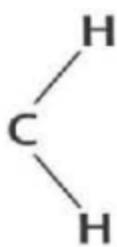
17.
Carbon can make a bond with hydrogen to form ethyne. Bond energy of C-H is same although 2s and 2p orbitals are involved which have difference in energies. Explain the formation of ethyne molecule on the basis of hybridization with the help of diagram.

18. Differentiate between a sigma bond and a pi bond.

19. Mass in gram of 0.74 mol $KMnO_4$.

20. Moles of O atoms in 9.22g $Mg(NO_3)_2$.

21. Number of O atoms in 0.037g $CuSO_4.5H_2O$.

22. Mass in kg of 2.6×10^{20} molecules of SO_3.

23. Total number of ions in 14.3g $CaBr_2$.

24. Mass in grams of 2.78×10^{21} molecules of N_2O_4.

25. Covalent bonds in 22 gram of dry ice.

26. Calcium ion can be precipitated from solution by sodium oxalate.

$$Ca^{2+} + Na_2C_2O_4 \underline{\quad} CaC_2O_4 + 2Na^+$$

27.
0.05 mol of potassium chlorate heated for a time and its 0.015 mol left. How much KCL produced, also calculate molecules of O_2 produced? $2KClO_3 — 2KCL + 3O_3,$

28. Calculate No. of moles of water produce by 5×10^{24} molecules of H_2SO_4 and 20g of NaOH.

29.
Formalin is an aqueous solution of formaldehyde $(HCHO)_3$ used as a preservative for biological specimens. A biologist wants to prepare 1dm³ of 11.5M formalin. What mass of formaldehyde he requires?

30. What mass of $CaCO_3$, would you use to add to 100cm³ of 0.5MHCL to completely neutralize acid?

$$CaCO_{3(S)} + 2HCL_{(aq)} \underline{\qquad\qquad} CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$$
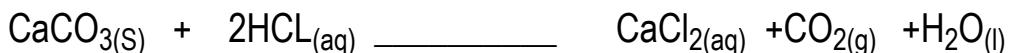
31. Calculate mass of oxygen required for complete combustion of 1 mole of gasoline (C_8H_{18}).

32. Graphite is the crystalline form of carbon used in "lead" pencil.

a) How many moles are present in 315mg graphite? b) How many carbon atoms are in it?

33 .
Manganese is transition metal essential for the growth of strong bones, Calculate mass of 3.22×10^{20} atoms of manganese found in 1 kilogram of bone?

34 . How much mass of excess reactant left after 40.5g of Aluminum metal reacts with 196g of H_2SO_4.

35 . Calculate mass of SO_2, that will be produced with 155g of Cu from the roasting of CuS.

$CuS + O_2$ _____ $Cu + SO_2$
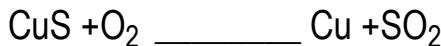
36 . Potassium super oxide (KO_2) is used as source of oxygen in re-breathing mask.

$4KO_2 + 2H_2O$ _____ $4KOH + 3O_2$ Identify limiting reactant in each of following reactant mixtures.

1) 6.4 moles KO_2 and 2.1 moles of H_2O. (1) 8.4 moles of KO_2 and 1.5 moles of H_2O.

37 . Critically evaluate the importance of the mole concept in understanding chemical reactions.

38 . Analyze the relationship between molar volume and Avogadro's number.

39 .
Compare and contrast the molar volumes of different gases under the same condition of temperature and pressure.

40 .
Explain on the basis of kinetic molecular theory. Why the boiling point of a liquid remains constant although heat is continuously supplied to the liquid?

41 .
(a) Define and explain vapour pressure. How equilibrium is established between evaporation and condensation?

(b) What are the factors affecting vapour pressure of fa liquid?

(c) Kinetically how will you explain the effect of temperature on vapour pressure?

42 . (a) Define and explain boiling point of a liquid?

(b) How will you explain the effect of pressure on the bolling point of a liquid?

(c) Practically how will you explain the(1) Effect of increase of pressure on boiling point.

(ii) Effect of decrease of pressure on boiling point.

43 .
(a) Define and explain the term viscosity of a liquid? How does the resistance to the layers causes viscosity?

(b) What are the factors affecting the viscosity of a liquid?

(c) Use the concept of hydrogen bonding to explain the water?(1) High surface tension

(2) High heat of vaporization(3) High boiling point

44 .

(a) Define and explain the phenomenon of surface tension?

(b) What are the factors affecting surface tension?

(c) Define dynamic equilibrium between two physical states?(d) Define?(1) Molar heat of fusion

(2) Molar heat of vapourization

45 . (a) Define a liquid crystal?(b) What are the uses of liquid crystals in daily life?

(c) How will you differentiate liquid crystals from pure liquids and crystalline solids?

46 . What are the energetics of phase changes?

47 . How can you interpret the anomalous behaviour of water?

48 . Evaluate the impact of temperature on surface tension of liquids.

49 . Evaluate the Importance of H-bounding in understanding physical properties of water.

50 . Differentiate between molar heat of fusion and molar heat of vaporization.