

MAHATMA GANDHI UNIVERSITY
CBCSS BSc PROGRAMME IN CHEMISTRY

Fifth semester

Core Course: CH5 B03-States of Matter

Model Question paper

Time:3 Hrs

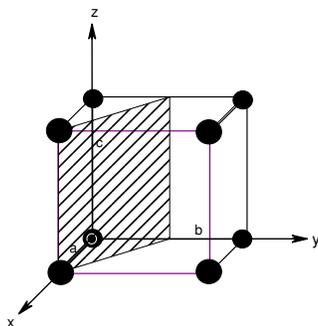
Total Weightage:25

Section A

(Answer all questions. A bunch of four questions carries a weightage of 1)

Questions 1-4 (Select the correct answer from among the choices given)

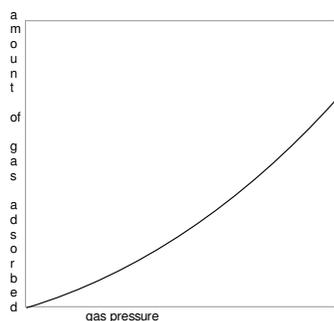
1. The critical volumes of four gases A, B, C and D respectively are 0.01L, 0.04L, 0.03L & 0.02L respectively. The gas with highest van der Waals constant, b is;
(a) B; (b) A; (c) D; (d) C
2. For a given sample of gas, the correct order of molecular velocity expressions is;
(a) most probable velocity > root mean square velocity > average velocity
(b) root mean square velocity > most probable velocity > average velocity
(c) average velocity > most probable velocity > root mean square velocity
(d) root mean square velocity > average velocity > most probable velocity
3. Pressure correction is accommodated in the van der Waals equation to account for;
(a) Intermolecular attractive force existing in real gases at low P and high T
(b) Intermolecular attractive force existing in real gases at high P and low T
(c) Molecular volume is not negligible for real gases at low P and high T
(d) Molecular volume is not negligible for real gases at low T and high P
4. The hkl indexing for the shaded lattice plane with intercepts, $1a$, $\frac{1}{2}b$, ∞c will be;



- (a) $(1\ 2\ \infty)$
- (b) $(1\ \frac{1}{2}\ \infty)$
- (c) $(1\ 2\ 0)$
- (d) $(\infty\ \frac{1}{2}\ 1)$

Questions 5-8 (Fill in the blank space with an appropriate word/term)

5. In NaCl crystal, sodium ions are caged in expanded -----voids set by the FCC lattice of chloride ions.
6. In.....point group, the elements are identity, proper rotational elements(C_3^1 , C_3^2) and three vertical plane reflections.
7. Colourful $KMnO_4$, $K_2Cr_2O_7$, $CuSO_4 \cdot 5H_2O$ crystals belong tocrystal system.
8. The following model of gas adsorption over a solid adsorbent, deviating from Langmuir model, is attributed toadsorption of gas molecules.



Questions 9-12 (In this bunch of four questions, two statements are given, former, an *assertion* which is labeled as **A** and the latter, a *reason* statement, labeled as **R**. Going through the following instructions, mark the correct choice.)

- (a) If **A** and **R** are correct and if **R** is the correct reason for **A**
 - (b) If **A** and **R** are correct and if **R** is not the correct reason for **A**
 - (c) If **A** is correct, **R** is not correct
 - (d) If **A** is not correct, **R** is correct
 - (e) If **A** and **R** are not correct.
9. Assertion **A**: CO_2 gas couldn't be liquefied at $50^\circ C$ taking compression as the means.
Reason **R**: Gases cannot be liquefied above their critical temperature by applying pressure.
(a); (b); (c); (d); (e)
 10. Assertion **A**: Non-stoichiometric NaCl crystals appear yellow in colour
Reason **R**: Excess chloride ions entrapped in NaCl lattice act as colour centres.
(a); (b); (c); (d); (e)
 11. Assertion **A**: Smectic liquid crystals do flow like true liquids.
Reason **R**: Smectic liquid crystals glide in layers
(a); (b); (c); (d); (e)
 12. Assertion **A**: A cubic atomic solid is expected to show maximum density if it crystallizes in BCC arrangement.
Reason **R**: Close packing efficiency is in the order, $BCC > FCC > Primitive\ Cubic$.
(a); (b); (c); (d); (e)

Questions 13-16 (Examine the following statements and find whether *true* or *false*)

13. Boyle temperature of a gas is the temperature at which its second virial coefficient vanishes.
14. The total energy of vibration per molecule per vibrational degree of freedom is $\frac{1}{2} kT$
15. Coefficient of gas viscosity is directly proportional to square root of temperature in absolute scale.
16. About S_3 axis, there can be only one *genuine improper rotation* operation possible.

Section B

(Answer any five questions. Each question carries a weightage of 1)

17. At what temperature does a plot of gas volume against temperature in $^{\circ}C$ cut the temperature axis?
18. Express the meaning of mean free path.
19. Mention the principle behind the Claude's method of liquefaction of gases.
20. What are the parameters correlated in Freundlich adsorption isotherm?
21. Why do X-ray wavelets get diffracted while encountering lattice particles in crystals?
22. Compute the effective number of α -iron metal kernels per unit cell, if it has BCC lattice.
23. Which are the elements combined in C_{2v} point group?
24. Express the Poiseuille's law applied in the viscosity measurement of liquids by Ostwald method.

Section C

(Answer any four questions. Each question carries a weightage of 2)

25. Express the Maxwell's law of distribution of molecular velocity and draw the major conclusions.
26. Derive the Virial equation of state and get an expression for Boyle temperature in terms of van der Waals constants.
27. Illustrate any two group properties making use of suitable example.
28. With a radius ratio of 0.40, which is the preferred lattice arrangement for ZnS crystal? Give unit cell sketch to support the answer.
29. How could you differentiate between NaCl and KCl crystals by X-ray diffraction studies?
30. Choosing an appropriate example, explain the thermographic behavior of a liquid crystal.

Section D

(Answer any two questions. Each question carries a weightage of 4)

31. Derive the van der Waal equation of state making volume and pressure corrections in the ideal gas equation and express the critical constants in terms of van der Waal constants.
32. Derive the Bragg's equation and show how the expression is made use in Bragg X-ray single crystal diffraction and Powder methods of crystal study.
33. Derive the Langmuir adsorption isotherm and also mention how the BET equation is handy in the determination of surface area of adsorbents.