

SECTION – D

Each question carries **15** marks. (Essay) Answer any **two** questions.

32. (a) Discuss the significance of Maxwell's equation for the distribution of molecular velocities and the effect of temperature on such distribution. **9**
- (b) An element occurs in the BCC structure with a cell edge of 275 pm. The density of the element is 70 g/cm³. How many atoms of the element does 200 g of the element contain? **6**
33. (a) Explain the *hexagonal close packing* and *cubic close packing* of uniform spheres. **4**
- (b) Discuss the terms: *space lattice*, *unit cell* and *Miller indices*. **6**
- (c) Given $E^{\circ}\text{Cd}^{2+}/\text{Cd} = -0.40 \text{ V}$ and $E^{\circ}\text{Cu}^{2+}/\text{Cu} = +0.34 \text{ V}$, represent the standard cell, give the electrode and cell reactions and calculate the standard emf. **5**
34. (a) What is a *point group*? Discuss the conditions that must be satisfied for a point group. **5**
- (b) State and explain Grotthus-Draper law and Stark-Einstein's law. **5**
- (c) Briefly discuss the *Michaelis-Menten equation* in respect of the kinetics of enzyme catalysis. **5**
35. (a) What are the different types of reversible electrodes? **4**
- (b) Discuss the quantum yield in terms of H₂-Cl₂ reaction. **6**
- (c) The rate constant of a second order reaction is $5.7 \times 10^{-5} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 25°C and $1.66 \times 10^{-6} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 40°C. Calculate the activation energy. **5**
- (2 × 15 = 30 Marks)**

(Pages : 4)

S – 3424

Reg. No. :

Name :

Third Semester B.Sc. Degree Examination, February 2024

First Degree Programme under CBCSS

Chemistry

Complementary Course for Physics

CH 1331.1 : PHYSICAL CHEMISTRY

(2020 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions. Each question carries **1** mark.

- For a gas for which v is the average velocity and 'Z' is the collision number, mean free path (λ) at a certain temperature is given by _____.
- What is Boyle temperature?
- Which Bravais lattice is represented by the unit cell parameters: $a = b \neq c$; $\alpha = \beta = 90^\circ$; $\gamma = 120^\circ$?
- Among NaCl, KCl, CsCl and CaF₂, which an ion structure with 8:8 coordination at ordinary temperature?
- What is meant by *chemiluminescence*?
- What is a *calomel electrode*?
- Sketch the conductance titration curve for HCl × NH₄OH.

8. How will you express the units of rate constant for the zero and third order reactions?
9. A *symmetry operation* is the movement of a molecule that brings it into a/an _____ configuration.
10. The order of the C_{2v} point group is _____.

(10 × 1 = 10 Marks)

SECTION – B

Each question carries 2 marks. (Short answer) Answer any **eight** questions.

11. What are the causes for the deviations of real gases from ideal behavior?
12. Assuming that CO_2 behaves as a van der Waals gas, calculate its Boyle temperature, critical temperature given $a=3.59 \text{ atm dm}^6 \text{ mol}^{-2}$ and $b=0.0427 \text{ L/mol}$.
13. At room temperature, iron crystallizes in bcc structure. How many atoms are associated with this unit cell?
14. What is meant by a *void* in a *close packed structure*? What are the two important types of *voids*?
15. What are fuel cells?
16. What is meant by transport number?
17. Define an *improper rotation axis*.
18. What is the role of *chlorophyll* in photosynthesis occurring in plants?
19. Name the point group to which the molecule belongs (a) HCl (b) XeF_4 (c) 1, 4-dichlorobenzene (d) BF_3 .
20. State the law of rationality of indices.
21. Explain why finely divided metals are more efficient catalysts as compared to their massive forms.
22. Write the Arrhenius equation and explain the terms.

(8 × 2 = 16 Marks)

SECTION – C

Each question carries 4 marks. (Short essay) Answer any **six** questions.

23. Define Mean free path. How does it vary with (a) increase in temperature and (b) decrease of pressure.
24. Give the *reduced equation of state* and explain the *law of corresponding states*.

$$\left[\pi + \frac{3}{\phi}\right](3\phi - 1) = 8\theta$$
25. Explain why the powder diffraction pattern for KCl is found different from that for $NaCl$.
26. The first order reflections from the (100), (110) and (111) planes of a crystalline substance were observed at the glancing angles 5.38° , 7.61° and 9.38° respectively. Calculate $d_{100} : d_{110} : d_{111}$. To which cubic lattice does the substance belong?
27. Define *centre of symmetry*. State whether the following molecules are *centrosymmetric* or not: (a) BF_3 (b) CH_4 (c) H_2 (d) $[PtCl_4]^{2-}$ (e) $CH_2=CH_2$ (f) PCl_5 .
28. Differentiate homogeneous and heterogeneous catalysis with one example each.
29. Explain the integrated rate law method for the determination of order of a reaction.
30. A solution of copper sulphate containing 100 g of the anhydrous salt in 1000 g of the solution was electrolysed between copper electrodes. After electrolysis, 55 g of the anode solution was found to contain 5.75 g of the salt. During electrolysis, 0.0047 g equivalent of silver was found deposited in a silver coulometer connected in series. Calculate the transport number of cupric and sulphate ions. (Equivalent mass of copper sulphate is 79.77)
31. When a monochromatic radiation is passed through 0.05 M solution of a substance, the intensity of the radiation is reduced to 25% of the initial value after passing through 10 cm length of the solution. Calculate the value of absorbance and molar extinction coefficient of the substance.

(6 × 4 = 24 Marks)