

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Second Semester B.Sc. Degree Examination, March/April 2021
BCH2C02 - Physical Chemistry
(2020 Admission onwards)

Time: 2 hours

Max. Marks: 60

Section A (Short answers)**(Answer questions up to 20 marks. Each question carries 2 marks)**

1. Under what conditions does a real gas approach ideal behaviour?
2. Define an isolated system. Give an example.
3. Calculate the R.M.S. velocity of O_2 molecule at $27^\circ C$.
4. Sketch the (200) planes of a face-centred cubic lattice.
5. The heat of reaction at constant volume is for the reaction, $CH_4(g) + 2O_2(g) \rightarrow CO_2(g)$ is 75.83 kJ, at 300 K. Calculate the heat of reaction at constant pressure, at 300 K.
6. State Henry's law. Give the unit of Henry's constant.
7. Why is aqueous solution of ferric chloride acidic?
8. One mole of water at 373 K changes to steam by absorbing 40.9 kJ of heat. If the work done by the system is 3.5 kJ, calculate the increase in internal energy.
9. Write the kinetic gas equation and explain the terms.
10. Calculate the degree of ionisation of NH_4OH in 0.02 M solution, the ionisation constant being $1.8 \times 10^{-5} \text{ mol L}^{-1}$ at $25^\circ C$.
11. How is entropy related to the heat exchanged reversibly in a process at constant temperature?
12. Calculate the concentration of an aqueous solution of a non-volatile solute which exerts an osmotic pressure of 3.731 atm at 300 K.

[Ceiling of marks: 20]

Section B (Paragraph)

(Answer questions up to 30 marks. Each question carries 5 marks)

13. (a) State and explain the third law of thermodynamics.
(b) Calculate the Gibb's free energy change at 25°C for the reaction,
 $\text{CO}_{(g)} + \text{Cl}_{2(g)} \rightarrow \text{COCl}_{2(g)}$. Given, $\Delta H = -109 \text{ kJ}$ and $\Delta S = -137 \text{ JK}^{-1}$. Predict whether the reaction is spontaneous or not.
14. (a) Derive an equation relating the enthalpy change and internal energy of a reaction.
(b) Distinguish between isothermal and adiabatic process.
15. Give the principle of conductometric titrations and discuss the conductometric titration curves of
(a) Strong acid against a strong base. (b) weak acid against weak base.
16. What is meant by an ideal gas? What are the causes of deviation of a real gas from ideal behaviour?
17. Explain the effect of dilution in the specific conductance and molar conductance of a strong electrolyte.
18. Explain the factors affecting the solubility of a gas in a liquid.
19. Discuss the various stoichiometric defects in crystals.

[Ceiling of marks: 30]

Section C (Essay)

(Answer any one. Each question carries 10 marks)

20. Derive Bragg equation and discuss its applications.
21. (a) What are fuel cells. Discuss the functioning of $\text{H}_2\text{-O}_2$ fuel cell
(b) Write the cell reaction and calculate the EMF of the electrochemical cell,
 $\text{Fe} | \text{Fe}^{2+} (0.1 \text{ M}) || \text{Cd}^{2+} (0.001 \text{ M}) | \text{Cd}$, at 25°C . Given, $E^{\circ}\text{Fe}^{2+}/\text{Fe} = -0.44 \text{ V}$
and $\text{Cd}^{2+}/\text{Cd} = -0.40 \text{ V}$

[1 X 10 = 10]

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
 Second Semester B.Sc Degree Examination, March/April 2021
 BMT2C02 – Mathematics – 2
 (2020 Admission onwards)

Time: 2 hours

Max. Marks : 60

PART A

Answer all questions. Each question carries 2 marks.

Maximum marks from this section is 20.

1. Convert the polar coordinate $(4, -\pi)$ into cartesian coordinate.
2. Differentiate $\cosh^{-1} x^2$
3. Consider the curve $x = 3 \cos t, y = \sin t$. Find the points where the tangent is horizontal.
4. Find $\lim_{n \rightarrow \infty} \frac{3n^2+1}{n^2+n}$
5. Evaluate $\int_0^{\frac{\pi}{2}} \cos x \, dx$ by using Trapezoidal rule with $n = 4$.
6. Show that the series $\sum_{i=1}^{\infty} 1 + \frac{1}{2^i}$ diverges.
7. Test the convergence of $\sum_{n=1}^{\infty} \frac{3^n}{n^2}$.
8. Give an example of a vector space. Explain your answer
9. Check whether the set of vectors $(3,5), (2,10)$ are linearly independent or not.
10. Find the inverse of the matrix $\begin{bmatrix} 1 & 3 \\ 4 & 10 \end{bmatrix}$
11. Verify that the matrix $A = \begin{bmatrix} \cos t & \sin t \\ -\sin t & \cos t \end{bmatrix}$ is orthogonal.
12. Evaluate the determinant of the matrix $A = \begin{bmatrix} 6 & 5 & 0 \\ -1 & 8 & -7 \\ -2 & 4 & 0 \end{bmatrix}$.

PART B

Answer all questions. Each question carries 5 marks

Maximum mark from this section is 30

13. Show that $\sinh^2 x = \frac{\cosh 2x - 1}{2}$
14. Find the length of the curve $f(x) = (x-1)^{\frac{3}{2}} + 2$ on $[1, 2]$.

15. (a) Write Alternating series test.

(b) Show that the series $1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \dots$ converges.

16. Find the Taylor series generated by $f(x) = e^x$ at $x_0 = 0$.

17. Let $B = \{u_1, u_2\}$, where $u_1 = (3, 1)$, $u_2 = (1, 1)$ is a basis for \mathbb{R}^2 . Find an orthogonal basis for \mathbb{R}^2 using the Gram - Schmidt orthonormalization process.

18. Solve the linear system

$$x_1 + 2x_2 - x_3 = 0$$

$$2x_1 + x_2 + 2x_3 = 9$$

$$x_1 - x_2 + x_3 = 3$$

Using Gaussian elimination.

19. Find the rank of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 4 \\ 1 & 4 & 1 \end{bmatrix}$

PART C

Answer any ONE question. One question carries 10 marks

20. (a) Graph the polar curve $r = \cos 2\theta$.

(b) Find the area enclosed by the cardioids, $r = 1 + \cos \theta$, $0 \leq \theta \leq 2\pi$.

21. Find the eigen values and corresponding eigen vectors of the matrix $A = \begin{bmatrix} 7 & 3 \\ 3 & 7 \end{bmatrix}$

Also verify Cayley Hamilton theorem.

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(Pages : 2)

Reg. No:.....

Name:

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
 Second Semester B.Sc Degree Examination, March/April 2021
BPH2B02 –Mechanics - II
 (2020 Admission onwards)

Time: 2 hours

Max. Marks : 60

The symbols used in this question papers have their usual meanings

Section A- Short Answer Type

(Answer all questions in two or three sentences,
 each correct answer carries a maximum of 2 marks)

1. A simple pendulum hangs in a car that has acceleration 'a'. What is the angle that the string of the pendulum makes with the vertical?
2. What are the two fictitious forces that act on object that moves with respect to a rotating frame?
3. Write down the expression for the time for the plane of oscillation to rotate once for a Foucault pendulum at latitude λ .
4. Give four general properties of central force motion?
5. What is meant by reduced mass? What is its advantage?
6. Give two advantages and disadvantages of resonance.
7. What is satellite maneuvering? Why is it required?
8. Write down the differential equation of a damped harmonic oscillator. What is its solution?
9. Write down the expressions for maximum kinetic energy, maximum potential energy, total energy and average total energy of a particle executing simple harmonic motion. Given that the displacement $x = A \cos(\omega_0 t)$.
10. What are the two minimum requirements of a medium to support mechanical wave propagation?
11. What is the difference between phase velocity and group velocity?
12. What is the unit of sound intensity level? How is it defined?

(Ceiling-20)

Section B- Paragraph/ Problem Type

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Calculate the deflection of a stone dropped from a height of 50m at the equator due to the Coriolis force.
14. Draw the variation of U_{eff} with separation r in the energy diagram. Show the various planetary orbits with different total energies.
15. Derive the dispersion relation for a longitudinal wave on a beaded spring with spring constant K , bead mass m and separation between the beads a .
16. A musician's tuning fork rings at 440Hz. The intensity of the sound produced decreases to one-fifth of its original intensity in 4 s. What is the Q factor of the tuning fork?
17. Halley's comet is in an elliptic orbit about the sun. The eccentricity of the orbit is 0.967 and the period is 76 years. The mass of the sun is 2×10^{30} kg, $G = 6.67 \times 10^{-11}$ Nm²/kg². Calculate the distance of perihelion and aphelion from the sun for this comet.
18. If the dispersion relation is $\omega^2 = \omega_p^2 + c^2 k^2$, obtain the phase velocity v_p .
19. Describe the cause of sea tides due to earth's revolution around the sun.

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Section C- Essay Type

(Answer any one question. Answer carries 10 marks)

20. Assuming the Fourier series expansion is valid for a periodic function $F(t)$, obtain the integral representation of a nonperiodic function $\psi(t)$.
21. Describe the equation of a damped harmonic oscillator. Assuming the solution for the displacement, explain the time dependence of amplitude and energy of oscillation and the quality factor.

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