Register Number:

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ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27

B.Sc. Biochemistry - I SEMESTER
SEMESTER EXAMINATION: December 2020
BCH 120 - BIOCHEMISTRY

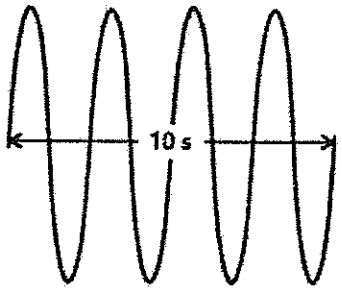
Time- 2 1/2 hrs **Max Marks-70**

This paper contains 3½ printed pages and three parts

Part A

Answer 10 out of 12 questions. Each question carries 2 marks **20 marks**

1. Why does water boil at a lower temperature at higher altitudes?
2. How does the increase in surface area affect the dissolution of a solute in a solvent?
3. What is meant by the N/P ratio in nuclear chemistry?
4. What is an electrolyte? Give an example of an electrolyte?
5. Give an expression that correlates ionic strength with the concentration of the electrolytic solution and explain the terms?
6. What information does the electrochemical series give us, explain with a suitable example?



7. Calculate the frequency of the wave shown
8. Draw the shape of the orbital with the following set of quantum numbers n=1, l =0,m_l =0 ,m_s = + ½
9. Draw the shape of the bonding and antibonding molecular orbitals formed by the combination of two 1s orbitals.
10. State any two postulates of Fajan's rule.
11. Give an example each for an (i) acidic buffer (ii)basic buffer
12. Calculate the pH of 0.001M HCl solution.

Part B

Answer 5 out of 7 questions. Each question carries 6 marks **30 marks**

13. Draw a schematic diagram of Berkeley and Hartley's apparatus for the determination of osmotic pressure. Explain the working principle briefly. What type of semi-permeable membrane did they use and why is it considered the best material?
14. Why does surface tension arise? Briefly explain how surface tension of a liquid is determined.
15. Justify the following statement: Oxidation always takes place at the anode, irrespective of its charge. (Hint: please draw the cells and explain)
16. a. State group displacement law and explain the different types of radioactive decay.
    b. A salt mixture contains Cu(II) and Zn(II). In the second group of salt analysis Cu(II) is precipitated as CuS and not Zn(II). But Zn(II) is precipitated as ZnS during 4th group analysis.
17. a. Write all quantum numbers for n=1 and n=2 levels.
    b. Write the quantum numbers of the electron with highest energy in the ground state of sodium (atomic number =11) (4+2)
18. a. Explain the coordinate bond formation between NH_3 and BF_3. (Please use the Lewis structure and VSEPR theory to describe the electron distribution and the shape of NH_3 and BF_3)
    b. What is a chelate? Draw the partial structure of hemoglobin. (3+3)
19. (i)Draw the molecular orbital diagram for O_2. Explain why an oxygen molecule is paramagnetic. (The atomic number of oxygen =8)
    (ii)Draw the Born Haber cycle for sodium chloride. Calculate the lattice energy of sodium chloride using the following data: The ΔH°_f (kJ mol^{-1}) of sublimation of $Na_{(s)}$= 89; Ionisation of $Na_{(s)}$= +425 ; Dissociation of $Cl_{2(g)}$ = +244 ; Electron gain by Cl(g) = -355 ; Formation of NaCl (s) = - 438. (3+3)

Part C

Answer 4 out of 6 questions. Each question carries 5 marks **20 marks**

20. Explain what you will observe and why when:
    a. 1 g of sugar is added to water and the solution boiled and the molecular mass determined. To another solution 1 g of NaCl is added and the solution boiled again, and molecular mass determined.
    b. A deep sea inexperienced diver rises rapidly to the surface.
    c. A naked egg, whose shell has been carefully removed, is placed in a concentrated solution of sodium chloride.
21. Consider the reaction, $2Ag^+ + Cd \rightarrow 2Ag + Cd^{2+}$
    The standard electrode potentials for $Ag^+ \rightarrow Ag$ and $Cd^{2+} \rightarrow Cd$ couples are 0.80 volt and -0.40 volt, respectively.
    a. What is the standard potential E° for this reaction?
    b. For the electrochemical cell in which this reaction takes place which electrode is a negative electrode?
22. a. Which of the following processes represents α –decay and why?
    (i) $^AX_Z + y \rightarrow {}^AX_{Z-1} + a+b$ (ii) $^AX_Z + {}^1n_0 \rightarrow {}^{A-3}X_{Z-2} + c$
    (iii) $^AX_Z \rightarrow {}^AX_{Z-1} + f$ (iv) $^AX_Z + e_{-1} \rightarrow {}^AX_{Z-1} + g$

b. Plutonium decays with a half-life of 24000 years. If plutonium is stored for 72000 years, the fraction of it that remains is: (please show the working)
(i)1/2 (ii)1/3 (iii)1/4 (iv)1/8

23. Water molecule is bent shaped whereas ICl_2^- is linear even though in both cases two identical terminal atoms are attached to a central atom. Give your arguments based on the VSEPR theory.

24. a.Fill the blanks in the following table as per the description given in the first column:

Description	Ethane (C_2H_6)	Ethene (C_2H_4)	Ethyne(C_2H_2)
Hybridisation of the C atoms	SP^3		
The Two C atoms are connected by		One sigma and one pi bond	
Total number of chemical bonds of all types			5

b.The boiling point of o-nitrophenol is less than that of p- nitrophenol. Give reason. (3+2)

25. a. Identify the Brønsted acid and its conjugate base in the following reaction: $HSO_{4\,(aq)}^- + OH_{(aq)}^- \rightarrow H_2O_{(l)} + SO_{4\,(aq)}^{2-}$. Give reasons for your conclusion.
b.100 cm^3 of an acidic buffer of pH 2 is diluted with 10cm^3 of water. What will be the new pH? (3+2)