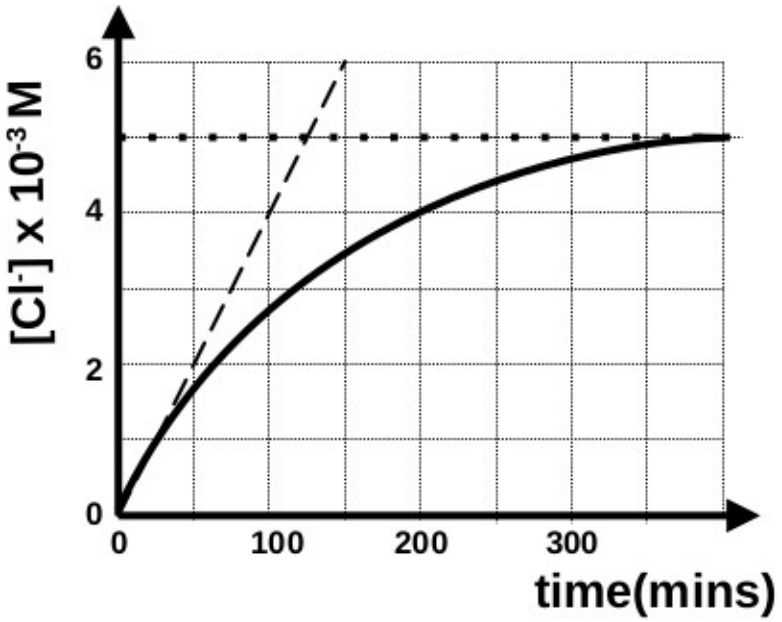
- This section contains Fifteen (15) questions
- Each question has FOUR options, ONE / MULTIPLE of these four options is/are the correct answer(s) or Question with Short Answer.
- Answer to each question will be evaluated according to the following marking scheme:
  - **Full Marks:** +4 If ONLY the correct option is chosen or correct answer is given
  - **Zero Marks:** 0 If none of the options is chosen (i.e. the question is unanswered);
  - **Negative Marks:** −1 In all other cases.

Question 1 : The first step of hydrolysis of cisplatin leads to formation of chloride (Cl^-) ions following first-order kinetics. The concentration of chloride ions is monitored as a function of time and is shown in the figure below. The dashed line represents the initial tangent line (slope) and the dotted horizontal line indicates the limiting value after a very long time.

Based on this data, the rate constant of the reaction is _____ $X10^{-3}$ min^{-1}.



A. 1.6

B. 4

C. 8

D. 40

Answer: C

Question 2: For large interparticle distances, the potential energy of interaction between two species (the species could be either an atom, a molecule or an ion) is observed to be proportional to $1/r^2$, where r is the distance between the centres of charges of the two species. The most likely combination of species that satisfies the given condition is

A. Ar and Ar
B. H^+ and Cl^-
C. CO and CO
D. CO and Na^+

Answer: D

Question 3: A 0.05 molal solution of potassium sulfate, K_2SO_4, in water depresses the freezing point by $0.26\ °C$. The degree of dissociation (α) of K_2SO_4 in this solution, is
Given: Freezing point depression constant for water, $K_f = 1.86$ K kg mol^{-1}.

A) 1.00
B) 0.90
C) 0.76
D) 0.14

Answer: B

Question 4: An ionic solid AB crystallizes in a cubic crystal system with a rock-salt (NaCl) structure, where A^+ cations and B^- anions are arranged in an FCC lattice. The edge length of the cubic unit cell is 402 pm, and the ionic radius of A^+ is 68 pm. The ionic radius of B^- is closest to ____ pm.

A) 280
B) 216
C) 142
D) 133

Answer: D

Question 5: One mole of an ideal monatomic gas at 300 K is first expanded reversibly and isothermally from 2 atm to 1 atm. The gas is then cooled at constant pressure of 1 atm, from 300 K to 120 K. Subsequently, half of the gas condenses to a liquid at constant temperature of 120 K and pressure of 1 atm. The total enthalpy change during the three steps is closest to ____ J.

Given: The heat of vaporization of the gas at 120 K and 1 atm pressure is 9000 J mol^{-1}.
The universal gas constant R = 8.3 J mol^{-1} K^{-1}

A. -8235
B. -6517
C. -12735
D. -9953

Answer: A

Question 6:

STATEMENT 1: The dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.

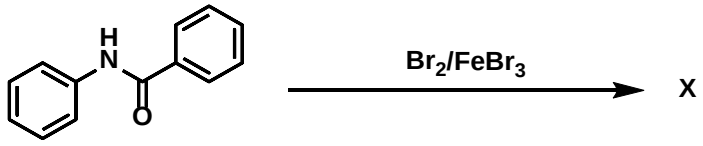
STATEMENT 2: In the most stable chair conformation of cyclohexylchloride, the chlorine atom is at the equatorial position.

A) Both statements 1 and 2 are **True** AND statement 2 is the correct explanation for statement 1
B) Both statements 1 and 2 are **True** BUT statement 2 is **NOT** the correct explanation for statement 1
C) Statement 1 is **False** BUT statement 2 is **True**
D) Statement 1 is **True** BUT statement 2 is **False**

Answer: B

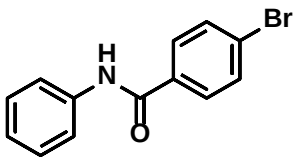
Question 7:

1. In the following reaction,

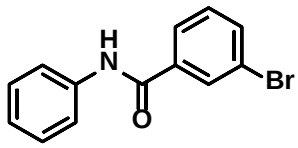


The structure of the major product '**X**' is

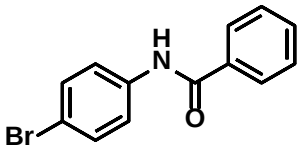
A)



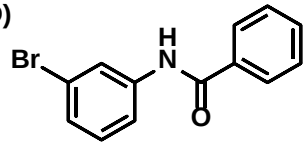
B)



C)



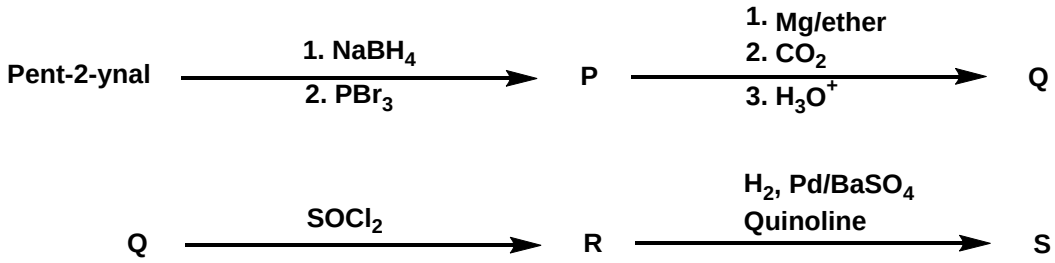
D)



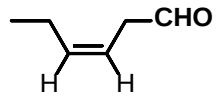
Answer: C

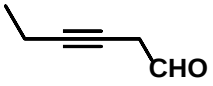
Question 8:

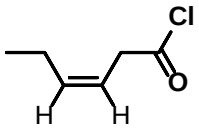
In the scheme 1 given, the structure of the major product '**S**' is

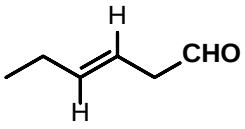


Scheme 1

A) 

B) 

C) 

D) 

Answer: A

Question 9:

1. Which carbohydrate given in the choices does not give a positive Fehling's solution test?

a) *L*-Glucose

b) *D*-Maltose

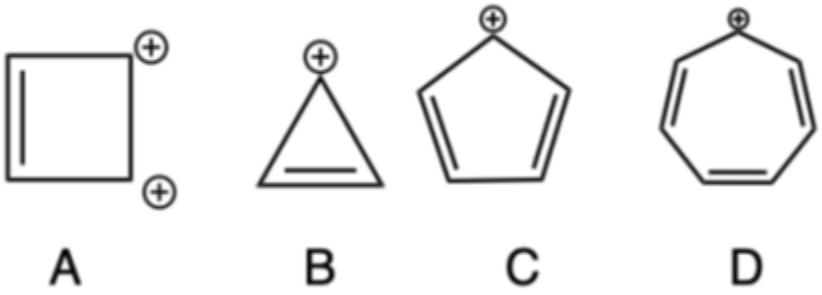
c) *L*-Fructose

d) *D*- Sucrose

Answer: D

Question 10:

Which of the following cations is aromatic according to Hückel's rule?



A) A and B only

B) B and D only

C) A, B and D only

D) B, C and D only

Answer: C

Question 11:

Identify the **correct** statement below:

(a) Two octahedral cobalt complexes with the same ligands appeared as orange and green: Co(II)(octahedral) complex is green, and Co(III)(octahedral) complex is orange.

(b) Two octahedral cobalt complexes with the same ligands appeared as yellow and violet: Co(II)(octahedral) complex is yellow, and Co(III)(octahedral) complex is violet.

(c) Two cobalt complexes with the same ligands appeared as red and blue: Co(II)(octahedral) complex is blue, and Co(II)(tetrahedral) complex is red.

(d) Two octahedral cobalt complexes with the same ligands appeared as yellow and violet: Co(II)(tetrahedral) complex is yellow, and Co(III)(tetrahedral) complex is violet.

Answer: A

Question 12:

Which among the following compounds can commonly be used as an oxidizing agent?

(a) $(NH_4)_2[Ce(NO_3)_6]$

(b) $Yb(NO_3)_2$

(c) $Eu(NO_3)_2$

(d) $La(NO_3)_3$

Answer: A

Question 13:

Identify the **incorrect** statement:

(a) The spin-only magnetic moment of $[V(H_2O)_6]^{3+}$ is 2.83 BM

(b) The spin-only magnetic moment of $[Cr(CN)_6]^{4-}$ is 4.90 BM

(c) The spin-only magnetic moment of $[Mn(H_2O)_6]^{2+}$ is 5.92 BM

(d) The spin-only magnetic moment of $[Cu(H_2O)_6]^{2+}$ is 1.73 BM

Answer: B

Question 14:

Dilute HNO_3 on reaction with copper metal gives a gaseous oxide of nitrogen. The **correct** statement about this gas is:

(a) This gas is paramagnetic.

(b) The oxidation state of N in this gas is + 5

(c) This gas is acidic in nature

(d) The color of this gas is blue

Answer: A

Question 15:

Among B_2^{2+}, C_2^{2-}, N_2^{2+}, and O_2^{2-} ions, the increasing bond order of the ions based on the MO diagram is:

(a) $B_2^{2+} < C_2^{2-} < N_2^{2+} < O_2^{2-}$

(b) $C_2^{2-} < B_2^{2+} < O_2^{2-} < N_2^{2+}$

(c) $N_2^{2+} < B_2^{2+} < O_2^{2-} < C_2^{2-}$

(d) $B_2^{2+} < O_2^{2-} < N_2^{2+} < C_2^{2-}$

Answer: D