2024
MATRICULATION EXAMINATION
DEPARTMENT OF MYANMAR EXAMINATIONS
CHEMISTRY

Time Allowed: 3 Hours
WRITE YOUR ANSWERS IN THE ANSWER BOOKLET
The symbols in this paper have their usual significance

SECTION (A)
(Answer ALL questions)

1. Write **TRUE** or **FALSE** for each of the following statements. **(10 marks)**

   (a) The elements with low electron affinity easily gain electrons, resulting in the formation of anions.

   (b) The heat absorbed or released in a process occurring at constant pressure is called the enthalpy change.

   (c) White phosphorus bursts into flames when exposed to air.

   (d) A catalyst does not affect the equilibrium concentrations, and there is no change in equilibrium.

   (e) Bronsted-Lowry acid is a proton donor.

   (f) Many transition elements and their compounds act as good catalysts for specific reactions.

   (g) Cadmium in the environment is not also toxic to plants, animals, and microorganisms.

   (h) Green chemistry is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances.

   (i) The IUPAC name of HCOOH is ethanoic acid.

   (j) Plastics that are thrown into the sea endanger marine animals.

2. Fill in the blanks with the correct word(s), notation(s), term(s), unit(s), etc., as necessary. **(10 marks)**

   (a) In solid ionic compounds, their ions are held in fixed positions and cannot move, and they cannot conduct _____ .

   (b) A bond's polarity is determined by the _____ of two bonded atoms.

   (c) A bomb calorimeter is used to measure the energy content of _____ .

   (d) During the progress of a reaction, an _____ intermediate is known as an activated complex.

   (e) If the equilibrium constant is _____ than 1, the equilibrium lies to the right, and there are more products than reactants.

   (f) Weak acids are weak _____ that partially ionize only to a limited extent in water.

   (g) _____ is primarily used in the production of stainless steel.

   (h) The cycling of the _____ chemical species has been altered by human activities.

   (i) _____ bombs are weapons with massive destructive power.

   (j) Each functional group has a characteristic absorption range of _____ .

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3. Choose **the best** answer for each question given in the following. (10 marks)

(a) In the HCl molecule, there are _____ unshared pair electrons in the Cl atom.

   A. two   B. three

   C. four   D. six

(b) A hair dryer converts _____.

   A. electrical energy into chemical energy   B. electrical energy into thermal energy

   C. chemical energy into mechanical energy   D. thermal energy into mechanical energy

(c) Digestive enzymes, such as _____, are present in saliva.

   A. pepsin   B. ptyalin

   C. protein   D. diastase

(d) If a reversible reaction occurs in the _____ system, the system can reach a state called dynamic equilibrium.

   A. open   B. closed

   C. isolated   D. individual

(e) When ionic compounds dissolve in water, _____ reactions occur.

   A. dissociation   B. reduction

   C. elimination   D. oxidation

(f) The first transition element of the $3d$ series is _____.

   A. zinc   B. vanadium

   C. scandium   D. titanium

(g) Iron and _____ are essential metals used in modern medicine.

   A. copper   B. manganese

   C. cobalt   D. chromium

(h) Radionuclides found in _____ are potassium-40, radium-226, and radium-228.

   A. water   B. air

   C. soil   D. atmosphere

(i) _____ can be used as solvents in marker pens, medicines, cosmetics, and as fuel.

   A. Esters   B. Alcohols

   C. Ethers   D. Aldehydes

(j) Nylon threads are made of _____.

   A. polypropylene   B. polyester

   C. polyamide   D. polyethene

SECTION (B)

4. Answer **All** questions.

(25 marks)

(a) (i) How many orbitals are there in the s, p, and d subshells? What are the shapes of these orbitals?

(ii) What is the result of the transfer of electrons from one electron to another?

(iii) Explain the transfer of the electron between magnesium ($_{12}Mg$) and oxygen ($_{8}O$) to form magnesium oxide using Lewis symbols.

(b) (i) What is the energy transformation?

    (ii) Calculate the standard enthalpy change of the decomposition of calcium carbonate;

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$ using the data given below.

$(\Delta H_f^\theta[CaO\ (s)] = -636\ kJ\ mol^{-1}, \Delta H_f^\theta[CO_2\ (g)] = -394\ kJ\ mol^{-1},$

$\Delta H_f^\theta[CaCO_3\ (s)] = -1207\ kJ\ mol^{-1})$

(c) (i) What is the expression for the rate of a reaction?

    (ii) According to the collision theory, what are the main factors that cause a chemical reaction to speed up?

    (iii) What are the factors affecting the rate of reactions?

(d) (i) Which molecules, N_2 and CO, are IR active or IR inactive? Give reasons.

    (ii) Name one reagent that is used to distinguish propanal from propanone (acetone).

    (iii) What is the IR absorption range of the hydroxyl (-OH bond) for alcohols and carboxylic acids?

(e) (i) Name the processes involved in the carbon cycle.

    (ii) What are the 7 R's of the green environment?

    (iii) Which mercury compound can accumulate in the bodies of living things? Describe the toxic effects of mercury on humans.

OR

(e) (i) What are the uses of carbon-14 and uranium-235?

    (ii) Which particles or rays are emitted from a radiactive substance? What is the penetrating power of each emitted particle or ray?

    (iii) What are bioplastics derived from and what are their uses?

5. Answer **All** questions.   (15 marks)

  (a) (i) What is the electronic configuration of the chromium atom (Z = 24)? Give a reason.

    (ii) Why are scandium (Sc^{3+}) and zinc (Zn^{2+}) ions colourless in an aqueous state?

  (b) (i) What is formed from two amino acids? Write down the equation.

    (ii) What type of polymerization would chloroethene undergo? Write down the equation.

  (c) (i) Calculate [H^+] in pure water using ionic product of water. ($K_w = 1.0 \times 10^{-14}\ mol^2\ dm^{-6}$)

    (ii) Classify the following salts and predict whether the salt solutions will be acidic, basic, or nearly neutral: $(NH_4)_2SO_4$; KNO_3; Na_2CO_3; NH_4F

    ($K_a = 5.6 \times 10^{-10}$ for NH_4^+ and $K_b = 1.4 \times 10^{-11}$ for F)

OR

  (c) (i) Calculate [H^+] and [OH^-] for a 0.02 mol dm^{-3} HNO_3 solution.

    (ii) Calculate the pH of a buffer solution containing 0.01 mol of ethanoic acid and 0.01 mol of sodium ethanoate per dm^3. ($K_a = 1.8 \times 10^{-5}$ for ethanoic acid)

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6. Answer **All** questions. (15 marks)

(a) (i) Write the balanced chemical equations for the following reactions:
- the reduction of propanone and the oxidation of ethanol.

(ii) What is the functional group that results after the oxidation of an aldehyde?

OR

(a) (i) Write the balance equations for the acidic hydrolysis and the basic hydrolysis of N-methylethanamide.

(ii) Give two uses of ester.

(b) (i) Which elements, manganese ($_{25}$Mn) and zinc ($_{29}$Cu), are diamagnetic or paramagnetic? Give reasons.

(ii) Give any two applications in industry for vanadium and cobalt elements.

(iii) Why is titanium used in surgical instruments?

(c) (i) Using Le Chatelier's principle, predict the effect of increasing temperature on the given chemical equilibrium.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$
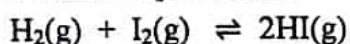
(ii) At a certain temperature, $K_{eq} = 10.5$ for the equilibrium $CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$. Calculate the concentration of H_2 in an equilibrium mixture containing 1.09 mol dm^{-3} of CO and 0.325 mol dm^{-3} of CH_3OH.

(iii) What is heterogeneous chemical equilibrium?

7. Answer **All** questions. (15 marks)

(a) (i) Classify the type of intermolecular forces.

(ii) Draw the Lewis structures and predict the molecular shapes of $BeCl_2$, SO_2 and CF_4.

OR

(a) (i) Compare the polarities of the pair of molecules of the compounds H_2O and CO_2.

(ii) What are the differences between metallic bonding and ionic bonding?

(b) (i) The formation of nitrogen dioxide from a reaction of nitrogen with oxygen in a car engine has ΔH value of + 33.2 kJ mol^{-1}. Write a chemical equation for the reaction. Is the reaction exothermic or endothermic?

(ii) If the conceration of H_2 is 0.674 mol dm^{-3} at time $t_1 = 1$ s and 0.526 mol dm^{-3} at time $t_2 = 2$ s after the reaction begins, Calculate the rate of the reaction.

$$H_2(g) + 2ICl(g) \rightarrow I_2(g) + 2HCl(g)$$
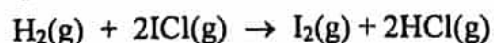
(c) (i) What happens when ethanol is treated with a limited amount of sulphuric acid and heated to 140 °C?

(ii) Draw a polymer formed between the two different monomers: an alcohol group (diol) and a dicarboxylic acid. What is this type of polymer?

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