OCR
Oxford Cambridge and RSA

A Level Chemistry B (Salters)

H433/01 Fundamentals of chemistry

Question Set 14

1 (a) Over the years, Chemists have investigated the origins of the elements and how life on Earthbegan.

Helium is formed in the Sun by fusion reactions.

Complete the nuclear equations below to show how helium is formed.

$$\text{.....}^{2}\text{H} + \text{.....}^{1}\text{H} \rightarrow \text{.....}^{3}\text{He} + \chi$$

$$\text{.....}^{3}\text{He} + \text{.....}^{3}\text{He} \rightarrow \text{.....}^{4}\text{He} + \text{.....} + \text{.....}$$

[2]

1 (b) There is a theory that the molecules of life were formed from elements made in stars. These molecules came to Earth from space on comets.

Recent analysis of comets has found compounds including methylamine.

Draw a 'dot-and-cross' diagram for methylamine, CH_3NH_2.

Label two **different** bond angles.

[3]

1 (c) Another theory is that life developed near hot vents deep under the sea. At these hot vents geothermally heated water rich in minerals emerges from the ocean floor.

Bacteria evolve and synthesise carbohydrates using hydrogen sulfide from the hot vent.These bacteria then form the basis of food chains for organisms such as tube worms.

$12H_2S + 6CO_2 \rightarrow C_6H_{12}O_6 + 6H_2O + 12S \quad \Delta_r H = -379.9\,\text{kJ mol}^{-1}$ **Equation 34.1**

Use the data in the table to find the enthalpy change of formation of glucose, $C_6H_{12}O_6$.

Substance	$\Delta_f H$ / kJ mol^{-1}
H_2S	–20.6
CO_2	–393.5
H_2O	–285.8
S	0

$\Delta_f H\ C_6H_{12}O_6$ = ……..kJ mol^{-1} **[3]**

1 (d) Analysis of water from a hot vent showed a variety of other minerals dissolved from theEarth's crust, such as copper chloride.

Give the electronic configuration of the chloride ion, using subshells and atomic orbitals.

[1]

1 (e) (i) Two students want to find the concentration of Cu^{2+} ions in some seawater from near a hot vent.

They use a titration method involving potassium iodide and sodium thiosulfate.

The potassium iodide is oxidised to iodine by the Cu^{2+} ions and the liberated iodine is titrated with sodium thiosulfate of known concentration.

$2Cu^{2+}(aq) + 4I^{-}(aq) \rightarrow 2CuI(s) + I_2(aq)$

$I_2(aq) + 2S_2O_3^{2-}(aq) \rightarrow 2I^{-}(aq) + S_4O_6^{2-}$

Name a suitable indicator the students should use and give the expected colour changeobserved.

Indicator .....

Colour change observed ……..

[1]

1 (e) (ii) The students are supplied with 0.020 mol dm^{-3} sodium thiosulfate. The students add excess potassium iodide to 50 cm^3 of the seawater and titrate with the sodium thiosulfate.

They find that their mean titre is only 0.95 cm^3 of sodium thiosulfate solution.

Use the students' results to calculate the concentration of Cu^{2+} ions in milligrams perdm^3 of seawater.

concentration = mg dm^{-3} **[3]**

1 (e) (iii) Calculate the percentage uncertainty in a titre of 0.95 cm^3.

percentage uncertainty = %

[1]

1 (e) (iv) What could the students do to reduce this percentage uncertainty to around 0.5%?

Describe their experimental method. **[2]**

Total Marks for Question Set 14: 16