exam café

Rehearse and remember

Practice exam 2 answers

VCE Chemistry Units 1 & 2

Chemistry

Practice Examination 2 Answers

The sample answers provided here are guidelines only as to what would be appropriate responses. Remember that, in order to satisfy the requirements of the external examination(s), you must submit work that is clearly your own.

Section A – Multiple-choice questions

1 C
2 A
3 D
4 C
5 A
6 B
7 C
8 C
9 B
10 C
11 A
12 B
13 D
14 D
15 A
16 D
17 B
18 C
19 B
20 A

SECTION B – Short answer questions

Question 1

a **i** Hydrogen

(1 mark)

ii Covalent

(1 mark)

b **i** The hydrogen bonds between water molecules in ice are relatively strong so a lot of energy can be absorbed before they break.

(1 mark)

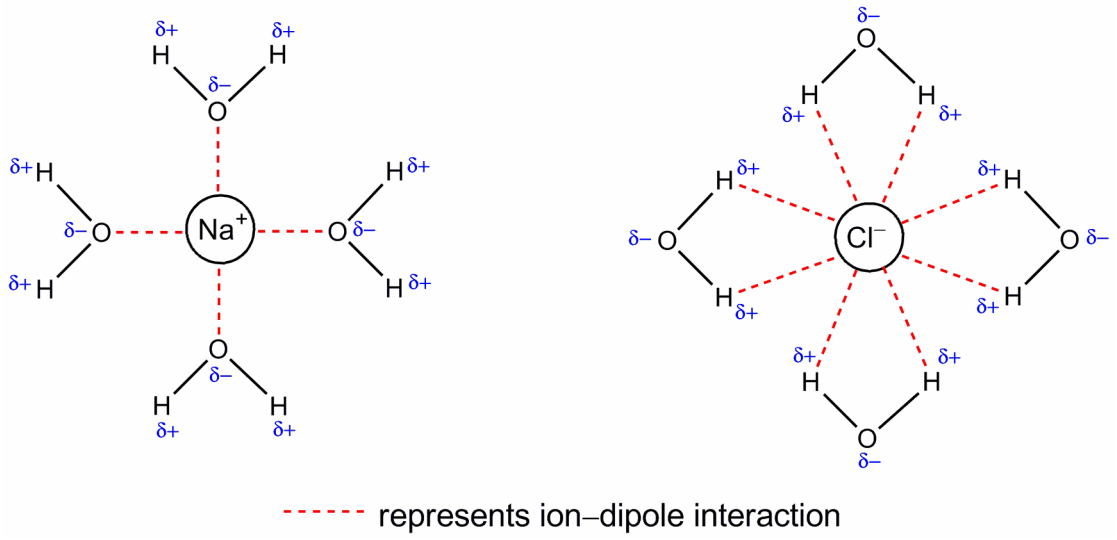
ii Each water molecule forms hydrogen bonds with four other molecules in a fixed arrangement, making the water molecules spread further apart than when in liquid form.

(1 mark)

c **i** $NaCl(s) \xrightarrow{H_2O(l)} Na^+(aq) + Cl^-(aq)$

(1 mark)

ii



iii $n(NaCl) = \dfrac{m}{M}$

$= \dfrac{5.00}{58.5}$

$= 0.0855$ mol (1 mark)

$c(NaCl) = \dfrac{n}{V}$

$= \dfrac{0.0855}{0.200}$

$= 0.427$ M (1 mark)

Question 2

a **i** A precipitation reaction is one in which two solutions are mixed and an insoluble substance is formed.

(1 mark)

ii For example:
$AgNO_3(aq) + KCl(aq) \rightarrow AgCl(s) + KNO_3(aq)$

(1 mark for equation, 1 mark for states)

iii colour, microorganisms (1 mark)

b One of:

- settling of floc so sludge can be removed
- filtration to remove suspended matter
- chlorination to kill bacteria.

(1 mark for name, 1 mark for purpose)

Question 3

a **i** $[OH^-] = 0.100 \times 2$ (1 mark)

$= 0.200$ M

$[H_3O^+] = \dfrac{10^{-14}}{[OH^-]}$

$= \dfrac{10^{-14}}{0.200}$

$= 5.00 \times 10^{-14}$ M (1 mark)

pH $= -\log_{10}[H_3O^+]$

$= -\log_{10}(5.00 \times 10^{-14})$

$= 13.3$ (1 mark)

ii $n(HCl) = \dfrac{m}{M}$

$= \dfrac{1.35}{36.5}$

$= 0.0370$ mol (1 mark)

$c(HCl) = \dfrac{n}{V}$

$= \dfrac{0.0370}{0.100}$

$= 0.370$ M (1 mark)

$[H_3O^+] = 0.370$ M

pH $= -\log_{10}[H_3O^+]$

$= -\log_{10}(0.370)$

$= 0.432$ (1 mark)

b $2HCl(aq) + Na_2CO_3(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$

(1 mark for correct species, 1 mark for correctly balanced)

c **i** $n(Ca) = \dfrac{m}{M}$

$= \dfrac{15.0}{40.1}$

$= 0.374$ mol

$n(CH_3COOH) = \dfrac{m}{M}$

$= \dfrac{15.0}{60.0}$

$= 0.250$ mol (1 mark)

$n(Ca) : n(CH_3COOH)$ is 1 : 2 so 0.374 mol of Ca would require 0.748 mol of CH_3COOH to fully react. CH_3COOH is the limiting reagent. (1 mark)

$n(Ca(CH_3COO)_2 = ½ \times n(CH_3COOH)$

$= ½ \times 0.250$

$= 0.125$ mol (1 mark)

$m(Ca(CH_3COO)_2 = nM$

$= 0.125 \times 158.2$

$= 19.8$ g (1 mark)

ii $n(H_2) = ½ \times n(CH_3COOH)$
$= ½ \times 0.250$
$= 0.125$ mol
$T = 273 + 15 = 288$ K (1 mark)
$P = 1.5 \times 101.3 = 152$ kPa (1 mark)

$$V(H_2) = \frac{nRT}{P}$$
$$= \frac{0.125 \times 8.31 \times 288}{152}$$
$= 1.97$ L (1 mark)

Question 4

a $2H^+(aq) + 2e^- \rightarrow H_2(g)$

(1 mark)

b $Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$

(1 mark)

c $Zn(s) + 2H^+(aq) \rightarrow Zn^{2+}(aq) + H_2(g)$

(1 mark)

d Oxidant $H^+(aq)$; reductant $Zn(s)$

(2 marks)

Question 5

a One of the following:

- Carbon dioxide: two of: colourless, odourless, does not support combustion, denser than air, sublimates at –78°C, slightly soluble in water, slightly acidic when dissolved in water, turns limewater milky.
- Oxygen: two of: colourless, odourless, slightly soluble in water, supports combustion, generally reactive.

(1 mark for each property up to 2 marks)

b One of the following:

- Carbon dioxide: A reaction between hydrochloric acid with calcium carbonate chips:
$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$
- Oxygen: Decomposition of hydrogen peroxide solution using manganese dioxide as a catalyst:
$2H_2O_2(aq) \xrightarrow{MnO_2} 2H_2O(l) + O_2(g)$

(1 mark for description, 1 mark for appropriate equation)

c Any two of:

- prevention of waste
- maximise atom economy
- use and generate substances with little or no toxicity
- design products for degradation into innocuous materials
- use solvents that pose no threat to the environment
- design of synthesis reactions that are energy efficient
- use starting materials that are renewable resources
- avoid derivatives
- monitor and control hazardous substances
- minimise possibility of chemical accidents.

(1 mark for each principle, up to 2 marks)

d **i** Acid rain forms when water vapour combines with different gases in the atmosphere. Equation could be one of:

$SO_2(g) + H_2O(l) \rightarrow H_2SO_3(aq)$
$SO_3(g) + H_2O(l) \rightarrow H_2SO_4(aq)$
$2NO_2(g) + H_2O(g) \rightarrow HNO_2(aq) + HNO_3(aq)$

(1 mark)

ii Any one of: Makes lakes acidic, which may kill organisms; makes soil acidic, which can damage plant root systems; damages the surfaces of plants.

(1 mark)

Question 6

a **i** Increasing the temperature of the gas increases the average kinetic energy of gas particles, making them exert more pressure on the walls of the can, which may then explode.

(2 marks)

ii The forces between gas particles are extremely weak so particles move around independently from each other and fill up a container.

(1 mark)

b Mass of coal $= 250\,000 \times 10^6$ g

m(C) $= 25.0\%$ of $250\,000 \times 10^6$
$= 6.25 \times 10^{10}$ g (1 mark)

$$n(\text{C}) = \frac{6.25 \times 10^{10}}{12.0}$$
$= 5.21 \times 10^9$ mol (1 mark)

$V(CO_2) = n \times V_M$
$= 5.21 \times 10^9 \times 22.4$
$= 1.17 \times 10^{11}$ L (2 marks)

(1 mark for answer expressed with two or three significant figures)