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CHEMISTRY
Unit 2 Trial Examination
SOLUTIONS BOOK

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Phone: 61 + 3 9385 3999 Fax: 61 + 3 9386 6722 E-mail: stav@stav.vic.edu.au Website: http://www.stav.vic.edu.au

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Use this page as an overlay for marking the multiple choice answer sheets. Simply photocopy the page onto an overhead projector sheet. The correct answers are open boxes below. Students should have marked their answers with a cross. Therefore, any open box with a cross inside it is correct and scores 1 mark.

1.		B	C	D
2.	A	B		D
3.		B	C	D
4.	A		C	D
5.		B	C	D
6.		B	C	D
7.	A	B	C	
8.	A		C	D
9.	A	B	C	
10.	A	B		D

11.	A	B	C	
12.	A	B	C	
13.	A	B		D
14.	A		C	D
15.	A	B		D
16.	A	B		D
17.	A	B	C	
18.	A	B		D
19.	A	B	C	
20.	A	B	C	

SECTION A

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

SECTION B

Question 1

a) mass spectrometer (1 mark)

b) The mass number of 87 represents the total number of protons and neutrons in the nucleus (1 mark) but 87.0 is the mass relative to ^{12}C set at 12 exactly (1 mark).

c) Let x = % ^{87}Rb

$$85.5 = \frac{85.0\ (100\ -\ x)\ +\ 87.0x}{100} \quad \text{(1 mark)}$$

$$85.5 = \frac{8500\ -\ 85.0x\ +\ 87.0x}{100}$$

$$8550 = 8500\ +\ 2x$$

$2x = 50.0$ therefore $x = 25.0$, so there is 25.0% ^{87}Rb (1 mark)

Question 2

a) $pH = -\log_{10}[H^+] = -\log_{10} 5.0 \times 10^{-5} = 4.3$ (1 mark)

b) since pH < 7, solution is acidic (1 mark)

c) $[H^+][OH^-] = 1.0 \times 10^{-14}$ at 25°C

so $[OH^-] = 1.0 \times 10^{-14}/5.0 \times 10^{-5} = 2.0 \times 10^{-10}$ M (1 mark)

d) In 100 mL of drain water, $n(H^+) = cV = 5.0 \times 10^{-5} \times 0.100 = 5.0 \times 10^{-6}$ mol (1 mark)

Need $n/V = 1.0 \times 10^{-7}$ therefore $V = n/1.0 \times 10^{-7}$

$= 5.0 \times 10^{-6}/1.0 \times 10^{-7} = 50$ L (1 mark)

So the 100mL sample would need to be diluted to 50 L to give pH = 7.0 (1 mark)

An alternative approach might be to use $c_1V_1 = c_2V_2$ since $n(H^+)$ is a constant

Question 3

a) (i) $n(CO_2) = \frac{1.76}{44.0} = 0.0400 \text{ mol}$ (1 mark)

(ii) $n(H_2O) = \frac{0.72}{18.0} = 0.040 \text{ mol}$ (1 mark)

b) (i) $n(C) = n(CO_2) = 0.0400$ mol

$m(C) = n(C) \times 12.0 = 0.0400 \times 12.0 = 0.48$ g (1 mark)

(ii) $n(H) = 2\, n(H_2O) = 2 \times 0.040 = 0.080$ mol (1 mark)

$m(H) = n(H) \times 1.0 = 0.080 \times 1.0 = 0.080$ g (1 mark)

c) $m(O) = m(\text{acid}) - [m(C) + m(H)] = 1.20 - (0.48 + 0.080) = 0.64$ g (1mark)

d) $n(O) = m/M = 0.64/16.0 = 0.040$ mol (1 mark)

$\therefore n(C) : n(H) : n(O) = 0.040 : 0.080 : 0.040 = 1.0 : 2.0 : 1.0$

$\therefore$ the EF is CH_2O (1 mark)

e) $m(\text{EF unit}) = 12.0 + 2(1.0) + 16.0 = 30.0$
molar mass is twice empirical formula mass (1 mark)

$\therefore$ molecular formula is $C_2H_4O_2$ (1 mark)

Question 4

$\frac{n(H_2)}{n(Fe)} = \frac{4}{3}$ (1 mark)

$n(H_2) = \frac{4}{3}\, n(Fe) = \frac{4}{3} \times \frac{m(Fe)}{M(Fe)} = \frac{4}{3} \times \frac{279}{55.9} = 6.65 \text{ mol}$ (1 mark)

$m(H_2) = n(H_2) \times M(H_2) = 6.65 \times 2 = 13.3$g (1 mark)

Question 5

a) $CaCO_3 + \mathbf{2}\, HCl \rightarrow CaCl_2 + H_2O + CO_2$ (1 mark)

b) $C_2H_4 + \mathbf{2}\, O_2 \rightarrow \mathbf{2}\, CO + \mathbf{2}\, H_2O$ (1 mark)

c) $\mathbf{6}\, CO_2 + \mathbf{6}\, H_2O \rightarrow C_6H_{12}O_6 + \mathbf{6}O_2$ (1 mark)

Question 6

a) Since n (H_2S) is a constant,

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \qquad P_2 = \frac{P_1 V_1 T_2}{T_1 V_2} = \frac{101.1 \times 3.0 \times 290}{298 \times 6.00 \times 10^5} \quad (1 \text{ mark})$$

$= 4.9 \times 10^{-4}$ kPa (1 mark)

b) (i) $n = \frac{PV}{RT} = \frac{4.9 \times 10^{-4} \times 6.00 \times 10^5}{8.31 \times 290} = 0.12$ mol (1 mark)

(ii) $c = n/V = 0.12/6.00 \times 10^5 = 2.0 \times 10^{-7}$ M (1 mark) which is well below the toxic concentration

Question 7

a) H_3PO_4 (1 mark)
b) $Ca(OH)_2$ (1 mark)
c) Fe_2O_3 (1 mark)
d) Na_2CO_3 (1 mark)

Question 8

a) $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$ (1 mark)

b) hydrochloric acid (1 mark)

c) $\frac{n(HCl)}{n(NaOH)} = \frac{1}{1}$

$n(HCl) = n(NaOH) = c \times V$

$= 0.300 \times 10.00 \times 10^{-3}$ mol $= 3.00 \times 10^{-3}$ mol (1 mark)

d) $n(HCl)_{total} = c \times V = 0.200 \times 40.00 \times 10^{-3} = 8.00 \times 10^{-3}$ mol (1 mark)

$n(HCl)_{\text{in excess}} = n(HCl)_{\text{total}} - n(HCl)_{\text{reacted}}$

$= 8.00 \times 10^{-3} - 3.00 \times 10^{-3} = 5.00 \times 10^{-3}$ mol (1 mark)

e) Titrations are repeated to minimize any random errors (1 mark) in using equipment such as balances, pipettes, burettes so that the titre obtained is a more accurate reflection of the true value.

Question 9

a) (i) $Pb(s) \rightarrow Pb^{2+}(aq) + 2e^-$ (1 mark)

(ii) $Au^+(aq) + e^- \rightarrow Au(s)$ (1 mark)

(iii) $Pb(s) + 2Au^+(aq) \rightarrow Pb^{2+}(aq) + 2Au(s)$ (1 mark)

b) (i) direction of electron flow from Pb to Au (1 mark)
(ii) Pb(-) and Au(+) (1 mark)
(iii) Pb is the anode and Au is the cathode (1 mark)

c) the oxidant is reduced , therefore the oxidant is Au^+ (1 mark)

d) Pb^{2+} ions are being produced in the Pb^{2+}/Pb half cell causing a net migration of NO_3^- ions towards this half cell (1 mark), therefore the $[NO_3^-]$ in the Au^+/Au half cell will decrease. (1 mark)

END OF SUGGESTED SOLUTIONS