STAV Publishing Pty Ltd 2003

CHEMISTRY

Unit 2

Trial Examination

SOLUTIONS BOOK

Published by STAV Publishing Pty Ltd. STAV House, 5 Munro Street, Coburg VIC 3058 Australia.
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ABN 51 007 165 611

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

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

SECTION A

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

(20 x 1 = 20 marks)

SECTION B

Question 1

a) $HCl\ (aq) + H_2O\ (l) \rightarrow H_3O^+\ (aq) + Cl^-\ (aq)$ (1 mark)

$CH_3COOH\ (aq) + H_2O\ (l) \rightleftharpoons H_3O^+\ (aq) + CH_3COO^-\ (aq)$ (1 mark)

b) A conjugate acid base pair differ by a proton. (1 mark)
If HNO_3 is the acid then NO_3^- is the conjugate base (1 mark)

c) A diprotic acid has two protons to donate. (1 mark)

$H_2CO_3(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + HCO_3^-(aq)$ (1 mark)

$HCO_3^-(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + CO_3^{2-}(aq)$ (1 mark)

d) As indicated by the equations in a), at any point in time virtually all HCl molecules ionise, whereas for CH_3COOH at any point in time, relatively few molecules have ionised. (1 mark)

Question 2

a) $C_3H_8(g) + \mathbf{5}O_2\ (g) \rightarrow \mathbf{3}CO_2\ (g) + \mathbf{4}H_2O\ (g)$ (2 marks)

b) (i) $n(C_3H_8) = \frac{660}{44.0} = 15\ \text{mol}$ (2 marks) (if kg used, deduct 1 mark)

(ii) $n(CO_2) = 3 \times n(C_3H_8)$ (1 mark)

$m(CO_2) = 3 \times n \times M = 3 \times 15 \times 44.0$

$m(CO_2) = 1980g = 2.0\ kg$ (1 mark)

c) (i) $N(C_3H_8) = n(C_3H_8) \times N_A = 15.0 \times 6.0 \times 10^{23} = 9.0 \times 10^{24}$ (1 mark)

(ii) $N(H) = 8 \times N(C_3H_8) = 8 \times 9.0 \times 10^{24} = 7.2 \times 10^{25}$ (1 mark)

Question 3

a) n(HCl) = c x V = 0.500 x 0.250 = 0.125 mol (1 mark)

b) n(HCl) from stock = n(HCl) in the diluted solution (1 mark)

c(stock) x V(stock) = 0.125 mol ; V(stock) = 0.125/10 = 0.0125 L

= 13 mL (1 mark)

c) Add about 50 mL of distilled water to the flask, carefully pour in 13 mL of the concentrated acid. Continue to add distilled water up to the 250 mL calibration mark. (1 mark)

Replace stopper and invert to mix thoroughly. (1 mark)

d) $pH = -\log_{10}[H^+] = -\log_{10} 0.50 = 0.3$ (1 mark)

Question 4

a) H_3PO_4 (1 mark)

b) $Ba(OH)_2$ (1 mark)

c) $Fe(NO_3)_3$ (1 mark)

d) $Mg_3(PO_4)_2$ (1 mark)

Question 5

a) A standard solution has an accurately known concentration. (1 mark)

b) (i) n(HCl) = c x V = $0.1105 \times 18.45 \times 10^{-3} = 2.039 \times 10^{-3}$ mol (1 mark)

(ii) n(NH_3) in 20.00 mL sample = 2.039×10^{-3} mol (1 mark)

n(NH_3) in 100.00 mL sample = $5 \times 2.039 \times 10^{-3}$ mol = 1.019×10^{-2} mol

(1 mark)

(iii) $[NH_3] = n/V = 1.019 \times 10^{-2} / 100 \times 10^{-3} = 0.1019$ M (1 mark)

Question 6

a) $2HCl$ (aq) + Na_2CO_3 (aq) → CO_2 (g) + $2NaCl$ (aq) + H_2O (l)

n(initially)	= c x V = 0.50x .150 = 0.075 mol (1 mark)	= c x V = 0.40 x 0.250 = 0.10 mol (1 mark)
n(reacting)	0.075 mol	0.0375 mol therefore Na_2CO_3 is in excess (1 mark)

b) n(CO_2) = n(Na_2CO_3 reacting) or n(CO_2) = ½ n(HCl) (1 mark)

PV = nRT , V= nRT/P (1 mark) (note that if P is in kPa, V will be in litres)

V(CO_2) = 0.0375 x 8.31 x 288 / 101.3 = 0.89 L (1 mark)

c) n(NaCl) = n(HCl) (1 mark)

[NaCl] = n/V = 0.075/0.400 = 0.19 M (1 mark)

Question 7

a) Zn is a better reductant than iron but copper is not. (1 mark)
With Zn, when the circuit is complete, Zn oxidises and the electrons are transferred to iron and reduction of water occurs instead. Hence the iron is protected. (1 mark)
With Cu, when the circuit is complete, Fe oxidises and electrons are transferred to the copper. (1 mark)

b) Both oxygen and nitrogen consist of non-polar molecules (1 mark) and therefore show little attraction to water molecules. (1 mark)

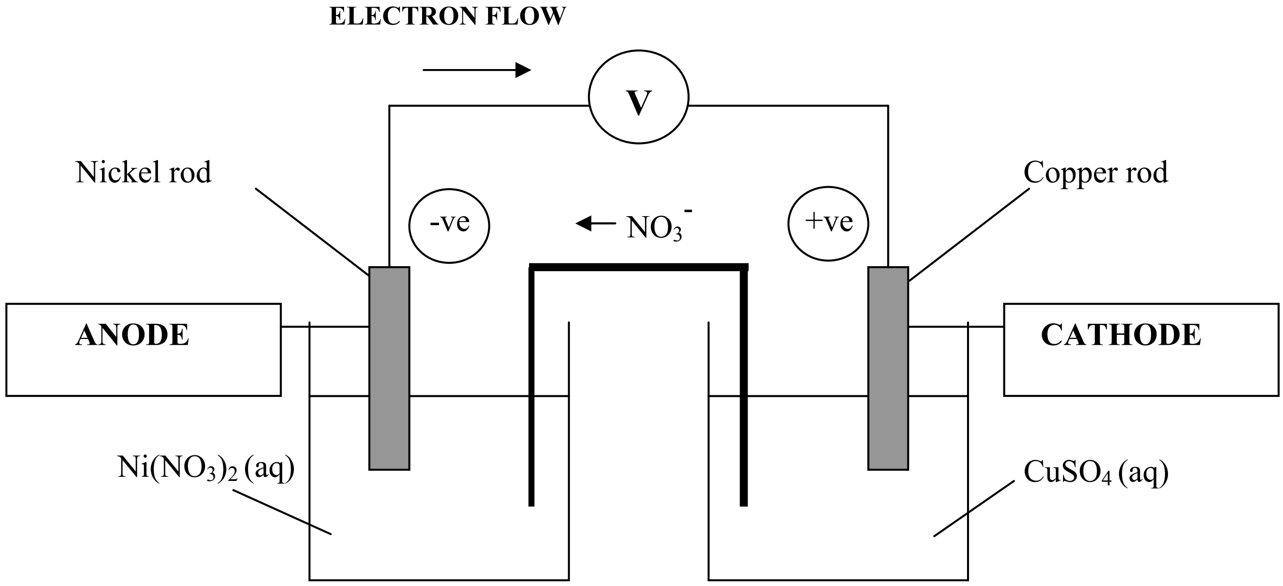
c) Nitrogen fixation is the conversion of gaseous nitrogen into compounds or ions containing nitrogen. (1 mark)

eg. N_2(g) + O_2 (g) → 2NO(g) (1 mark) or

N_2(g) + $3H_2$ (g) → $2NH_3$(g)

d) Boyle's Law states that for a fixed amount of gas and constant temperature (1 mark) pressure is inversely proportional to volume. (1 mark)

Question 8



a) As indicated on diagram (1 mark for each part) (4 marks total)

b) $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ (1 mark)

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

c) oxidant is Cu^{2+} (1 mark)

reductant is Ni (1 mark)

END OF SUGGESTED SOLUTIONS