CSE CENTRE FOR STRATEGIC EDUCATION
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IARTV

CSE TEST – OCTOBER 2009

YEAR 11 – CHEMISTRY

Written test 2

ANSWERS & SOLUTIONS BOOK

SECTION A – Multiple choice questions (20 marks)

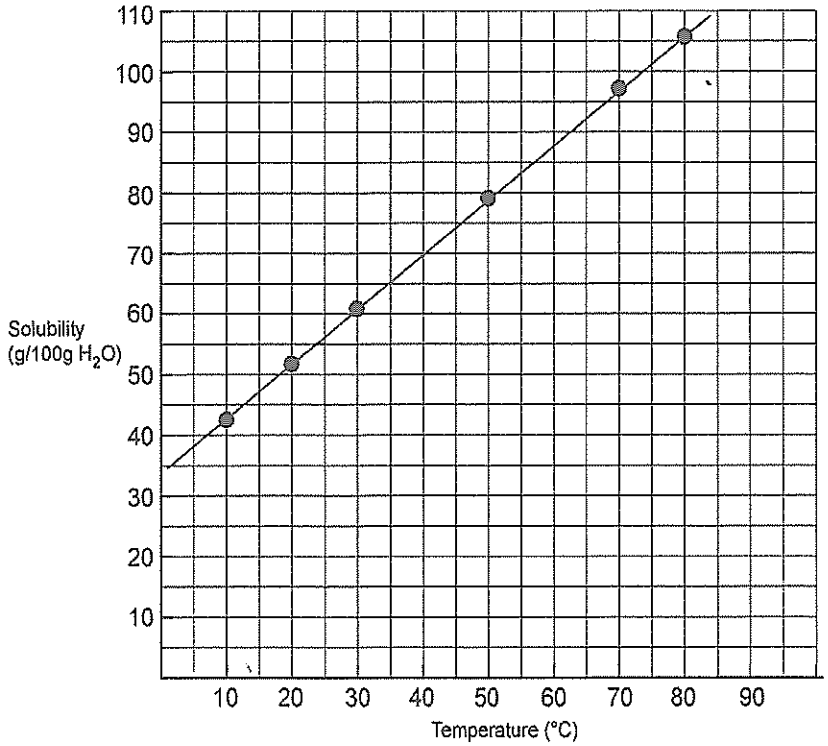
1	A	5	A	9	B	13	D	17	D
2	C	6	C	10	B	14	C	18	A
3	C	7	D	11	D	15	D	19	D
4	A	8	B	12	C	16	B	20	B

SECTION B – Short answer questions (55 marks)

1 mark is indicated by *

Question 1 (9 marks)

a. ** 2 marks



b. 84 g * (allow 83 g) 1 mark

c. Solubility at 75°C = 102 g / 100g water or 91.8 g / 90 g of water * 2 marks
Solubility at 20°C = 52 g / 100 g water or 46.8 g / 90 g water *

Mass of $Z(NO_3)_2$ that crystallises = (91.8 – 46.8) g = 45 g * 1 mark

d. Solubility at 30°C is 61 g / 100 g water
Mass $Z(NO_3)_2$ dissolved in 543 g water = 61 x 543/100 = 331.2 g = 1 mol *
$A_r(Z)$ = [331.2 – (2 x 14) – (6 x 16)] = 207.2 *
From Periodic Table, element is Lead * 3 marks

Total 9 marks

Question 2 (6 marks)

a. $Q_{(s)} \rightarrow Q^{2+}_{(aq)} + 2e^-$. *
$R^{2+}_{(aq)} + 2e^- \rightarrow R_{(s)}$ *\
2 marks

b. $Q_{(s)} + R^{2+}_{(aq)} \rightarrow Q^{2+}_{(aq)} + R_{(s)}$ *
1 mark

c. c. ⟶ *
1 mark

d. R / R^{2+} half cell. *
1 mark

e. No
Reasons: **either** relative atomic masses of Q and R are different, although moles are the same, **or** all mass deposited may not remain on the electrode. *
1 mark

Total 6 marks

Question 3 (12 marks)

a. $H_2C_2O_{4(aq)} \rightleftharpoons H^+_{(aq)} + HC_2O_4^-{}_{(aq)}$ *
$HC_2O_4^-{}_{(aq)} \rightleftharpoons H^+_{(aq)} + C_2O_4^{2-}{}_{(aq)}$ *
2 marks

b. i H_2SO_4 *
ii $H_2C_2O_4$ *
iii H_2SO_4 *
3 marks

c. i $[OH^-] = (0.050 \times 2)$ M = **0.10 M** *

Since $[H_3O^+] \times [OH^-] = 10^{-14}$ M^2
$[H_3O^+] = 10^{-14} / 0.10 =$ **1×10^{-13} M** *
2 marks

ii $pH = -\log_{10}[H_3O^+] = -\log_{10}13 =$ **13** *
1 mark

d. $n(H_3O^+) = (5.0 \times 10^{-3} \times 0.5) = 2.5. \times 10^{-3}$ mol. *
volume solution = 100 mL
after dilution $[H_3O^+] = (2.5 \times 10^{-3} \times 10^3 / 100)$ M = $2.5. \times 10^{-2}$ M
pH = 1.6 *
2 marks

e. Oxalic acid is a weak acid and is not completely ionised in aqueous solution, therefore the number of moles of hydrogen ions produced is less than the number of moles of oxalic acid in the solution given by the molarity. *
1 mark

Total 11 marks

Question 4 (6 marks)

a. $Pb(NO_3)_{2(aq)} + 2KI_{(aq)} \rightarrow 2KNO_{3(aq)} + PbI_{2(s)}$ *

or $Pb^{2+}_{(aq)} + 2I^-_{(aq)} \rightarrow PbI_{2(s)}$

1 mark

b. $n(Pb(NO_3)_2) = (60 \times 10^{-3} \times 2.5)$ mol = 0.15 mol *
$n(KI) = (60 \times 10^{-3} \times 2.0)$ mol = 0.12 mol *

2 marks

c. mol ratio $Pb(NO_3)_2 : KI = 1:2$, therefore 0.15 mol $Pb(NO_3)_2$ requires 0.3 mol KI for complete reaction. n(KI) is only 0.12 mol therefore KI reacts completely and $Pb(NO_3)_2$ is in excess. *
0.12 mol KI reacts completely with 0.12/2 = 0.06 mol $Pb(NO_3)_2$
$n(Pb(NO_3)_2)$ remaining = (0.15 – 0.06) mol = 0.09 mol. *
$m(Pb(NO_3)_2$ remaining = (0.09×331.2) g = 3×10^1 g (corr. 1 sig fig.) *

3 marks

Total 6 marks

Question 5 (9 marks)

a. mol ratio NO : Cu = 2 : 3 *
n(NO) = 2/3 x n(Cu) = 2/3 x (20.0/63.6) = 0.2096 mol *
v(NO) = (0.2096 x 24.5) L = 5.136 L = 5.14 L (corr. 3 sig. fig.) *

3 marks

b. Increase in v(NO) = (20/100 x 5.14) L = 1.03 L *
New v(NO) = (5.14 + 1.03) L = 6.17 L *
T = PV/nR = (101.3 x 6.17/ 0.21 x 8.314) K = 358K = 85°C. *

3 marks

c. $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$ *

1 mark

d. $n(NO) = 0.2096$ mol = $n(NO_2)$ *
$m(NO_2) = (0.2096 \times 46)$ g = 9.6 g (corr. 2 sig. fig.) *

2 marks

Total 9 marks

Question 6 (9 marks)

a. oxygen: $2H_2O_{2(aq)} \xrightarrow{\textit{Manganese dioxide}} 2H_2O_{(l)} + O_{2(g)}$ *

carbon dioxide: $CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$ *

2 marks

b.
1. hydrogen peroxide solution */2
2. manganese dioxide powder */2
3. oxygen gas */2
4. water */2

2 marks

c. Carbon dioxide is too soluble in water to be collected by displacement of water. *

1 mark

d. For example, any of:

i Use the minimum amount of reactants to produce only the required amount of product.
If one reactant is in excess, use the minimum excess.
If possible retain the product, for later use.
If possible retain the catalyst, if used, for later use. *

ii Carry out reaction at room temperature if possible.
Use minimum heating or cooling when necessary.
Turn off any energy consuming equipment when not in use.
Use a catalyst if possible to make reactions energy efficient. *

iii Have clear rules on appropriate behaviour in labs.
Students should be aware of any hazardous chemicals and their appropriate use to minimise the possibility of accidents
Students should be familiar with, and use, safe procedures to minimise the possibility of accidents, fires etc.*

iv Use a procedure in which the maximum possible number of reactant atoms are converted into product. *

4 marks

Total 9 marks

Question 7 (5 marks)

a. F Particles of a gas sample at a particular temperature have an average velocity but individual particles move with a range of velocities. *

b. F The density of ice under these conditions is less than that of water as the molecules are further apart and in fixed positions due to hydrogen bonding. *

c. T A redox reaction involves electron transfer. In the oxidation half reaction electrons are lost by the reductant. These electrons are then gained by the oxidant in the reduction half reaction. Thus the two half reactions must occur together. *

d. F A precipitate will only form if one of the possible products is insoluble. If both possible products are soluble there will be no precipitate. *

e. T The number of moles indicates the number of reacting particles. Substances react in particle ratios related to the particle ratio in the products formed, not to their mass ratios.*

5 marks

Total 5 marks

END OF ANSWER BOOK