* # * *	NEW TOWN SECONDARY SCHOOL Preliminary Examination Secondary 4 Express / 5 Normal (Academic)	
NAME		
CLASS	INDEX NUMBER	
Science (C	5076, 5078	

Paper 3 Chemistry

1 hour 15 minutes

ANSWERS

This document consists of 8 printed pages.

1			4
	description	substance	
	contributes to acid rain	nitrogen dioxide	
	used to control pH in soils	calcium hydroxide	
	reacts with both acids and bases	zinc oxide	
	is used to fill tungsten bulbs	argon	

2	(a)	Isotopes are two or more atoms of the same element, with the <u>same number of</u> protons, but different number of neutrons.				1		
	1							
	(b)				number of			4
				protons	neutrons	electrons		
			a ²⁴ Mg atom	12	12	12		
			a ²⁵ Mg ion	12	13	10		
	(C)	C: The	chemical formula	for magnesium of	hloride will alway	s be MgCl ₂ .		
		E: Sinc configu	e the number of ration of all isotop	electrons for all bes of Mg is <u>2,8,2</u>	isotopes of Mg a	tom is 12, the ele	ectronic	1
		R: This hence f	means that they forming the chemi	will all need to <u>lo</u> ical formula MgCl	ose 2 valence ele 2.	<u>ctrons</u> to chlorine	atoms,	1

 3
 (a)
 Beryllium is reduced because the oxidation state of beryllium decreases from +2 in 1
 1

 BeCl₂ to 0 in Be;
 Potassium is oxidised because the oxidation state of potassium increases from 0 in 1
 1

 K to +1 in KCl;
 K to +1 in KCl;
 1

(b)	Potassium <u>reacts explosively</u> with water and is dangerous / used up before it can react with beryllium chloride.	1
	Reject if merely mention "reacts with water".	

4	(a)	Carbon monoxide <u>combines with haemoglobin</u> / <u>binds irreversibly with haemoglobin</u> in blood (to form carboxyhaemoglobin), which <u>reduces the ability</u> of haemoglobin to <u>transport oxygen</u> to the rest of the body,	1
		causing headache/fatigue/breathing difficulties/death in human.	1
	(b)	No. of moles of CO = 0.14 g / (12+16)	
		= <u>0.005 mol</u>	1
		2 moles of CO : 1 mole of O ₂	1
		Volume of O_2 used = (0.005/2) mol x 24 dm ³	
		= 0.06 dm ³ or 60 cm ³	1
	1		
	(c)	<pre>image: the second second</pre>	2
		1m for correct number of shared electrons.	
	(d)	Carbon dioxide has a <u>simple molecular structure</u> with <u>weak intermolecular forces of</u> <u>attraction</u> between the molecules. Hence, <u>little / not much energy</u> is required to overcome these forces.	1
		All 3 points for 2m 2 points for 1m	

students' mistakes	corrections to mistake
<u>Copper</u> powder	<u>Copper(II) oxide/carbonate</u> powder
Heat the filtrate until <u>most of the solvent</u> has evaporated	Heat the solution until <u>saturation.</u>
Rinse the crystals with <u>large amounts of</u> cold water	Rinse the crystals with <u>a little</u> cold distilled water.

Both mistake + correction to be correct to obtain 1m.



7	(a)	K – iron(II) sulfate / FeSO ₄	1
		L – barium sulfate / BaSO4	1
		M – iron(II) hydroxide / Fe(OH) ₂	1
		N – iron(III) hydroxide / Fe(OH) ₃	1
	(b)	$\begin{array}{lll} \mbox{Fe}(NO_3)_2 \ + \ 2NaOH & \mbox{Fe}(OH)_2 \ + \ 2NaNO_3 \ OR \\ \mbox{Ba}(NO_3)_2 \ + \ \mbox{Fe}SO_4 & \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	2
		1m correct formulas 1m balancing of equations	

8	(a)	Gradual change in physical properties as number of C atoms increases	2
		Same functional group	
		Same general formula	
		The molecular formula of each member differs from the next by a unit of $-CH_2$	
		Similar chemical properties	
		Any 2	
-	(b)	Circle the –COOH functional group and label 'carboxylic acid'	1
		H = H = H = H = H = C $H = C = C = C = C = C$ $H = C = C = C$ $C = C = C$ $C = C = C$ $C = C$ C C C C C C C C C	
	(c)	$\begin{array}{ccccc} H & H & H & O \\ H - C - C - C - C \\ H & H & H \end{array}$	1
	(d)	Nickel	1

Paper 3 Section B (20 marks)

9	(a)	(i)	Colour gets darker down the group.	1
			Melting / boiling point increases down the group.	
			Density increases down the group.	
			Any 1	
	1			-
		(ii)	Black solid remains in colourless solution. Accept: no visible change.	1
			Astatine is less reactive than iodine, hence, it is <u>unable to displace</u> iodide ions from potassium iodide.	1
	(b)	(i)	$\begin{bmatrix} \bullet \bullet \bullet \\ \bullet \bullet \end{bmatrix}^{-} \begin{bmatrix} \star \star \star \\ \star & Ca \\ \star & \star \end{bmatrix}^{2+} \begin{bmatrix} \bullet \bullet \\ \bullet \bullet \end{bmatrix}^{-}$	2
			Note:	
			- correct number of valence electrons for both ions	
			- correct charge written for both ions	
			 correct number of ions (2 for Cl⁻) / can accept '2' written in front of 1 Cl⁻ diagram 	
			1 or 2 points, 1m	
			All 3 points to get 2m	
		(ii)	C: It <u>cannot conduct electricity</u> [1].	2
			R: The ions are in a fixed crystal lattice and <u>cannot move around freely</u> [1].	
	(c)	1) <i>F</i>	Add the silver nitrate solution to a beaker containing sodium chloride (or other	3
		201L	ible chionae / nyarochiona ada) solution. [1]	
		∠) <u>Γ</u> 3) \/	Vash the residue with cold distilled water and dry residue between pieces of filter.	
		0) <u>v</u>	<u>vasir</u> me residue with colu distilled water and <u>dry</u> residue between pieces of litter er [1]	
		pap		

10	(a)	(i)	Silicon dioxide.	1
		(ii)	Limestone [1] and coke / carbon [1].	2
	1			
		(iii)	The limestone decomposes in the furnace to produce calcium oxide and	2
			CaCO ₃ (s) \checkmark CaO (s) + CO ₂ (g)	
			The calcium oxide reacts with sand / silicon dioxide to produce molten slag, which is removed from the blast furnace. [1]	
			$CaO\ (s) + SiO_2\ (s) \to CaSiO_3\ (l)$	
			Explanation need not be accompanied by an equation.	
	I			
	(b)	(i)	No of moles of Ee ₂ O ₃ = $\frac{2}{55 \times 2 + 15 \times 3}$	
			= 0.0125 mol	1
		(ii)	No. of moles of KOH = 0.02 dm ³ x 4.00 mol/dm ³ = 0.08 mol	1
		(iii)	1 mole of Fe_2O_3 : 10 moles of KOH	1
			0.0125 moles of Fe ₂ O ₃ : 0.125 moles of KOH	
			Since $0.125 \text{ mol} > 0.08 \text{ mol}$, KOH is the limiting reactant.	
			Working can be shown the other way round as well (using KOH as the starting	
			point)	
			point).	
			vorking is not required to obtain the answer.	
		(iv)	10 moles KOH : 2 moles K ₂ FeO ₄	2
		()	0.08 moles KOH : $\frac{2}{10} \times 0.08 = 0.016$ moles K ₂ FeO ₄ [1]	
			Mann of K. Eq. $= 0.016 \times (20 \times 2 + 56 + 46 \times 4) = 2.47 \times (45.2 + 51)$	
			$10 \times 4 = \frac{3.17 \text{ g}}{10 \times 2100 \text{ g}}$	

44	()	(1)	600°C / high temperature	4
11	(a)	(1)	Aluminium oxide or silicon dioxide as catalyst	1
			Both conditions to obtain 1m.	
		(ii)	C ₃ H ₈	1
			Reject "propane" as question asks for molecular formula.	
		(iii)	Test: Add aqueous bromine to each sample.	1
		()	Observation: If reddish-brown bromine is decolourised, that sample is ethene.	1
			If reddish-brown bromine remains, that sample is X.	
			Both positive and negative results must be mentioned to obtain 1m.	
	•			•
	(b)			1
		H	-C-C-O-H	
		Reje	ect if O-H is drawn as "OH" without the bond.	
	(c)	(i)	At high temperature, the enzyme in yeast will be denatured and the reaction	1
	(0)	(1)	stons	'
			Accept yeast will be denatured without mentioning enzyme.	
		(ii)	The <u>blue litmus paper will turn red</u> [1] and (the red litmus paper remains red).	2
			This is due to the presence of ethanoic acid formed from the oxidation of	
			ethanol. [1]	
		(iii)	$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$	2
		(11)	1m correct formulas	2
			1m balancing of equations	
			lanore state symbols	
			Ignore state symbols.	