PEARSON EDEXCEL IGCSE CHEMISTRY · 4CH1

CHEMISTRY



MARK SCHEME

SECTION 1: PRINCIPLES OF CHEMISTRY (PACK 4)

SCORE	PERCENTAGE
/212	%

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Mark Scheme

Q1.

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>(a)</td><td>
<table>
<tr><th>Change</th><th>Change of state</th></tr>
<tr><td>water to ice</td><td>freezing</td></tr>
<tr><td>steam to water</td><td>condensation</td></tr>
<tr><td>solid wax to liquid wax</td><td>melting</td></tr>
<tr><td>iodine crystals to iodine vapour</td><td>sublimation</td></tr>
</table>
</td><td>ALLOW condensing

ALLOW subliming</td><td>4</td></tr>
<tr><td>(b) (i)</td><td>M1 heat

M2 stir / mix</td><td>ALLOW use hot water
IGNORE add more water

ALLOW grind / crush the solid / mixture</td><td>2</td></tr>
<tr><td>(ii)</td><td>filter</td><td>ALLOW a description of filtration</td><td>1

4</td></tr>
</table>

(iii)	A description that refers to four of the following points: **M1** heat / boil (the solution) **M2** evaporate some of the water **M3** leave / cool (the solution to crystallise) **M4** pour off excess liquid **OR** filter (to obtain crystals) **M5** suitable method of drying the crystals	**IGNORE** any steps before heating the solution **ALLOW** until crystals form on the end of a glass rod **ALLOW** until crystals first start to form **ALLOW** until the solution is saturated **M3** dep on **M1** **M4** dep on crystals having been formed **IGNORE** references to washing e.g. place in an oven / leave to dry /use filter paper / kitchen towel / / desiccator / heat to dryness If solution heated until **all** the water evaporates / heated until **all** the water has been removed / heated to **dryness** award **M1** and **M5** If the solution is left to evaporate **all** of the water only **M5** can be awarded.	**Total 11**

Q2.

Question number	Answer	Notes	Marks
(a) (i)	M1 dissolving M2 diffusion	Answers can be in either order	2
(b) (i)	An explanation that links any two of the following points M1 crystals dissolve faster M2 (potassium iodide/ lead nitrate/ water) particles move faster / (lead/ iodide) ions move faster / rate of diffusion increases M3 therefore (lead and iodide) ions/ particles meet / collide after a shorter period of time/ sooner	 **ALLOW** (potassium iodide /lead nitrate/ water) particles have more energy **ALLOW** molecules in place of particles if referring to water **IGNORE** references to more collisions or more energetic collisions	2
(c) (i) (aq) (ii)	3 / three 2+ /+2	 **ALLOW** Pb	1 1
(d)	$Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$	**ALLOW** multiples and fractions	1
			7 marks

Q3.

Question number	Answer	Notes	Marks
(a)	Any two from the following: M1 contains 3 dyes M2 contains (dye) A M3 contains (dye) B M4 does not contain (dye) C / contains an unknown dye OWTTE		2
(b) (i)	(Ink 2) is insoluble (in solvent/water)	ALLOW does not contain (dye) A/B/C	1
(ii)	(repeat) using different solvent	ALLOW named alternative solvent eg alcohol/ethanol	1
(c)	M1 correct measurement of distance moved by spot AND correct measurement of distance moved by solvent M2 use and evaluation of $R_f = \frac{\text{distance moved by spot}}{\text{distance moved by solvent front}}$ M3 answer to 2 sig fig	ALLOW 5.4-5.6 ALLOW 7.9-8.1 Expected: $\frac{5.5}{8.0} = 0.6875$ = 0.69 ALLOW ECF from M1 M2 correct answer with no working scores 3	3
			(Total for Question = 7)

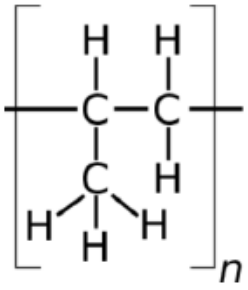
Q4.

Question number	Answer	Notes	Marks
(a)	M1 (same) solvent M2 (same type of chromatography) paper	**ALLOW** (same) named solvent eg water **IGNORE** reference to size/length **of paper** **ALLOW** reference to use of pencil (for start line)/spots must start on horizontal line /solvent must start below line or spots **ALLOW** same distance travelled by solvent **IGNORE** distance of line from bottom of paper **IGNORE** amount/volume/concentration of solvent /references to size/volume of dyes or spots /references to temperature/time	2
(b) (i)	C is insoluble (in the solvent)		1
(ii)	M1 Student 2 and dye D/(R_f value) 1.20 M2 because R_f value must be less than 1 / cannot be greater than 1	 ALLOW spot cannot move further than solvent front OWTTE	2

Question number	Answer	Notes	Marks
(c)	M1 (R_f =) $\frac{9.7}{12}$ M2 = 0.808(33..) M3 = 0.81 (to 2 SF)	 0.808(33..) with no working scores **M1** and **M2** **ALLOW M2** ECF if used 10.7 or 13 and $R_f < 1$ **ALLOW** 1 mark for $\frac{12}{9.7}$ = 1.2(37..) **ALLOW M3** ECF **M2** (must be correct to 2 SF) 0.81 with no working scores 3	3

Q5.

Question number	Answer	Notes	Marks
(a) (i)	M1 alkanes M2 because fits general formula C_nH_{2n+2}	 M2 not dep on M1	2 Grad
(ii)	D	ALLOW C_3H_8	1 cler
(iii)	M1 (compounds of F with same molecular formula /C_4H_{10}) but different structural/displayed formulae M2 structural/displayed formula of butane M3 structural/displayed formulae of methylpropane		3 Exp
(b)	a description including the following points M1 heat/vapourise crude oil M2 pass into (fractionating) column/tower M3 fractions/compounds/molecules/hydrocarbons separate because of different boiling points M4 compound D collected at top of column/in refinery gas fraction	 ALLOW boil ALLOW idea of temperature gradient All marks could be scored from a suitably labelled diagram MAX 3 if description of lab process If confusion with cracking only M1 can be awarded	4 Exp

Question number	Answer	Notes	Marks
(c) (i)	addition (polymer)	REJECT additional	1 Cler
(ii)	poly(propene) / polypropene	ALLOW polypropylene	1 grad
(iii)	 M1 correct repeat unit M2 brackets and n and extension bonds	Ignore bond angles ALLOW use of CH_3 M2 DEP M1	2 Exp
		Total for Q = 14	

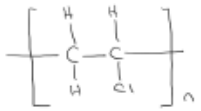
Q6.

Question number	Answer	Notes	Marks
(a)	M1 magnesium loses two electrons M2 (each of two) chlorine atoms gains one electron	**ACCEPT** magnesium becomes 2.8 **ACCEPT** (each of two) chlorine atoms becomes 2.8.8 M1 and M2 can be scored from correct diagrams No M1 M2 if reference to covalent bonding or sharing electrons	2
(b) (i)	M1 $\frac{(35 \times 70) + (37 \times 30)}{100}$ M2 35.6(0)	 correct answer of 35.6(0) with or without working scores 2	2
(ii)	(both isotopes have) the same electron configuration / arrangement	**ALLOW** (both isotopes have) the same number of electrons (in their outer shell)	1
(c) (i)	M1 exothermic M2 the temperature increases	 **ALLOW** heat energy is given out	2
(ii)	Any one from: polystyrene is a (good) insulator to reduce/prevent heat loss (to the surroundings)	 **IGNORE** references to safety	1
(iii)	M1 $\Delta T = 27.5$ M2 $100 \times 4.2 \times 27.5$ M3 = 11 550	 **ALLOW** ecf from M1 **ALLOW** 2 or more significant figures **ALLOW** ecf from M2 Correct answer 11 550 with or without working scores 3 115.5 scores 2	3
		Total for question	= 11 marks

Q7.

Question number	Answer	Notes	Marks
(a)	Any five from M1 fractional distillation M2 crude oil heated/vapourised M3 reference to (fractionating) column/tower M4 which is hotter at the bottom than at the top M5 shorter hydrocarbons/chains/molecules have lower boiling point (and rise higher/towards the top) M6 fractions/hydrocarbons/gases/vapours/kerosene condense(s) at (levels depending on) their boiling points OWTTE	 **ALLOW** boiled **ALLOW** reference to temperature gradient **ALLOW** the hydrocarbons/gases/vapours cool as they rise up the column **ACCEPT** reverse argument **ALLOW** correct reference to position of kerosene fraction below refinery gases and gasoline fractions or above diesel and fuel oil fractions	5

(b)	(i)	C_8H_{18}		1
	(ii)	Any four from		4
		M1 fractional distillation/crude oil produces more long-chain hydrocarbons than can be used (directly)	**ALLOW** short(er) chain hydrocarbons are in higher demand/more useful than long(er) chain hydrocarbons ORA	
		M2 cracking produces short chain alkanes	**ALLOW** cracking changes long(er) chain hydrocarbons into short(er) chain hydrocarbons	
		M3 short chain alkanes/hydrocarbons are more flammable/can be used as fuels		
		M4 cracking produces alkene(s)	**IGNORE** named alkene	
		M5 alkenes can be used to make polymers	**ALLOW** named alkene forming (named) polymer e.g. ethene can be used to make poly(ethene)/polymer	

(c)	A Addition The only correct answer is A because the reaction between an alkene and a halogen forming a halogenoalkane is addition. B is not the correct answer since this reaction is not combustion. C is not the correct answer since this reaction is not decomposition. D is not the correct answer since this reaction is not substitution.		1
(d) (i)	 M1 single bond between the two carbons **and** single bonds to three hydrogens and one chlorine M2 two extension bonds and n	n can be anywhere after brackets extension bonds do not have to go through brackets M2 dep on M1	2
(ii)	M1 they are inert/unreactive M2 (so) they are non-biodegradable/ do not (naturally) break down/decompose (in landfill sites) OR M1 when burned M2 they produce toxic fumes	**ALLOW** take long time to break down (so landfill sites may fill up)	2
		Total for question = 15 marks	

Q8.

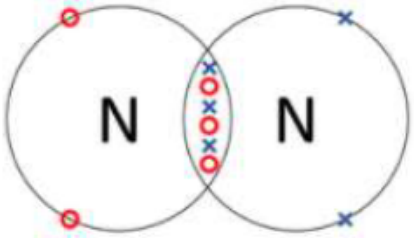
Question number	Answer	Notes	Marks
a	**2** C_2H_4 + **4** HCl + **(1)** O_2 → **2** $C_2H_4Cl_2$ + **2** H_2O	**ACCEPT** multiples and fractions	**1**
b	breaking down by heating OWTTE		**1**
c i	(it) contains a (carbon to carbon) double bond		**1**
ii	**M1** add bromine water/solution **M2** (bromine water/solution) is decolourised/ turns (from orange to) colourless	**ACCEPT** Br_2(aq) as long as the state symbol is present **IGNORE** clear **REJECT** discoloured If initial colour of bromine water given it must be correct- **ALLOW** any combination of orange/yellow/brown **M2** dep on **M1** or near miss **ALLOW** **M1** add acidified potassium manganate(VII) **M2** potassium manganate(VII) is decolourised/turns (from purple) to colourless **REJECT** any other initial colour	**2**
d	poly(chloroethene) /polychloroethene	**ACCEPT** polyvinyl chloride **ALLOW** PVC	**1**

Q9.

Question number	Answer	Notes	Marks
(a) (i)	M1 <u>atoms</u> of the same element / <u>atoms</u> with the same number of protons /<u>atoms</u> with the same atomic number	**REJECT** different number of electrons **IGNORE** same number of electrons	2
	M2 (with a) different number of neutrons / different mass number		
(ii)		correct answer without working scores 3	3
	M1 (63 x 69.5) + (65 x 30.5) **OR** 6361		
	M2 their M1 ÷ 100 **OR** 63.61		
	M3 63.6	**ALLOW** answer to **M2** to 3 sig figs 63.61 without working scores 2	
(b) (i)	**A** decomposition		1
	B is incorrect as it is not a neutralisation reaction C is incorrect as it is not an oxidation reaction D is incorrect as it is not a reduction reaction		
(ii)	**C** green to black		1
	A is incorrect as copper(II) carbonate is not blue B is incorrect as copper(II) carbonate is not blue and copper(II) oxide is not white D is incorrect as copper(II) oxide is not orange		

(c)	(i)	(28.20 – 20.52 =) 7.68		1
	(ii)	(31.77 – 28.20 =) 3.57		1
	(iii)	**M1** 7.68 ÷ 159.5 **OR** 0.04815 **M2** 3.57 ÷ 18 **OR** 0.1983 **M3** 0.1983 ÷ 0.04815 **OR** 4.12	correct answer without working scores 3 **ALLOW** ecf from (i) and/or (ii) for **M1** and **M2**; and **M3** provided the answer rounds to 4 **REJECT** incorrect rounding in **M1** or **M2** **ALLOW** any number of sig figs in **M1** and **M2** except 1 Penalise 1 sig fig once only	3
	(iv)	not all the water was removed (from the hydrated copper(II) sulfate)	**ALLOW** the (hydrated copper(II) sulfate) was not heated for long enough **ALLOW** not all the water left the tube (that was being heated) **ALLOW** not all the (hydrated copper sulfate) reacts	1 **Total 13**

Q10.

Question number	Answer	Notes	Marks
(a) (i)		ALLOW dots, crosses or any combination.	2
	M1 6 bonding electrons		
	M2 2 non-bonding electrons on each atom	M2 dep on M1	
(ii)	M1 shared pair(s) of electrons		2
	M2 attracted to (two) nuclei	REJECT nucleus. Must be plural for M2. M2 dep on mention of electrons in M1	

(b)	(i)	diamond		1
	(ii)	Any four from:		4
		M1 graphite is giant covalent	ALLOW giant structure if M2 is scored REJECT molecules of graphite	
		M2 (in melting graphite) covalent bonds are broken	ALLOW description of covalent bonds	
		M3 (C_{60}) (simple) molecular structure	ALLOW molecules of C_{60}	
		M4 (in melting C_{60}) intermolecular forces (of attraction) are overcome	ALLOW breaking bonds in C_{60} if intermolecular forces clearly mentioned M4 subsumes M3	
		M5 more energy is needed to break covalent bonds (in graphite) than intermolecular forces (in C_{60})		
			Mention of intermolecular forces in graphite no M2 or M5	
			Mention of breaking covalent bonds in C_{60} no M4 or M5	
				Total for question = 9 marks

Q11.

Question number	Answer	Notes	Marks
(a)	M1 X is darker in colour than kerosene ORA M2 X has higher boiling point than kerosene ORA M3 X is more viscous than kerosene ORA		3
(b) (i)	M1 3 CO_2 + 9 H_2O M2 10 O_2	 M2 dep on M1	2
(ii)	carbon monoxide reduces the capacity of the blood to transport oxygen OWTTE	**ACCEPT** correct references to haemoglobin / carboxyhaemoglobin	1
(iii)	An explanation including any three of the following: M1 (common impurity in fuels is) sulfur M2 (sulfur) burns/combusts/reacts (in air/ oxygen) to form sulfur dioxide/SO_2 M3 sulfur dioxide/SO_2 dissolves in/reacts with rain/water (to form) M4 acid rain		3
(c) (i)	M1 single bond between the carbons and each carbon single bonded to two hydrogens M2 two extension bonds and n after the bracket	 M2 dep on M1	2
(ii)	M1 poly(ethene) is unreactive/does not react/inert M2 (so) non-biodegradable/does not decompose/does not break down (in landfill sites)	 **ALLOW** takes many years or a long time to decompose/break down OWTTE **ALLOW** reference to space is limited in landfill sites OWTTE	2
		Total for question	= 13

Q12.

Question number	Answer	Notes	Marks
(a) (i)	M1 add anhydrous copper sulfate M2 turns (from white) to blue	ALLOW add white copper sulfate M2 dep on copper sulfate in M1 ALLOW M1 add anhydrous / blue cobalt chloride M2 turns (from blue) to pink M2 dep on cobalt chloride in M1	2
(ii)	M1 measure the boiling point / freezing point M2 100 °C / 0°C	ALLOW boil it or freeze it Value must match property	2
(b)	M1 mass of hydrated zinc sulfate = 54.46-41.64 **OR** 12.82 g M2 Moles of hydrated zinc sulfate = 12.82÷287 **OR** 0.0447 M3 Moles H_2O = 0.0447×7 **OR** 0.313 M4 Mass H_2O = 5.63 g M5 Volume H_2O 5.6 cm^3	 ALLOW M1÷287 ALLOW M2×7 ALLOW M3×18 Must be 1dp ALLOW M4 to 1dp Correct answer of 5.6 cm^3 to 1dp with or without working scores 5 marks	5
(c) (i)	1.7	ALLOW 2 or more significant figures REJECT incorrect rounding	1
(ii)	M1 stand the measuring cylinder in a beaker of ice OR M1 replace the delivery tube with a (Liebig) condenser M2 less water / water vapour / steam lost	ALLOW any way of cooling the measuring cylinder or delivery tube ALLOW add a condenser IGNORE add a stopper / bung ALLOW more water (vapour) / steam condenses ALLOW less water evaporates	2
			Total for question = 12

Q13.

Question number	Answer	Notes	Marks
(a)	$2\ H_2O_2 \rightarrow 2\ H_2O + (1)\ O_2$	**ALLOW** multiples and fractions	1
(b)	Relights a glowing splint/spill		1
(c)	Speeds up/increases rate of the reaction	**IGNORE** references to lowering activation energy	1
(d) (i)	All points plotted correctly	**ALLOW** ± half a square	1
(ii)	Point at 8 minutes circled		1
(iii)	Smooth curve of best fit		1
(iv)	took the reading too soon/before 8 minutes	**ACCEPT** misread the volume (of oxygen)	1
(v)	**M1** vertical line on graph drawn to curve from 3 mins **M2** value obtained from candidate's graph	Expected value 29 or 30 cm^3 **ALLOW** ± half a square	2

Question number	Answer	Notes	Marks
(e) (i)	**M1** curve drawn on graph that is less steep than curve of student's results. **M2** curve levels off at 40 cm^3	 **ALLOW** ± half a square	2
(ii)	An explanation that links the following three points **M1** reaction is slower **M2** fewer particles/molecules (in the same volume) **M3** fewer collisions per unit time	 **ACCEPT** particles are further apart / less crowded **ACCEPT** less frequent collisions **IGNORE** less chance of a collision	3
			Total 14

Q14.

Question number	Answer	Notes	Marks
(a) (i)	so that the (hot) lead does not react with oxygen/air (converting back into lead oxide)	**ACCEPT** so that lead is not oxidised (back to lead oxide)	1
(ii)	M1 repeat the heating M2 until the mass remains constant/ does not change	**ACCEPT** heat to constant mass for both marks	2
(b) (i)	4.66 (g)		1
(ii)	0.48 (g)		1
(iii)	• calculate the moles of lead and oxygen • divide by the smaller number • calculate the whole number ratio • give the empirical formula Example calculation **M1** $\frac{4.66}{207}$ and $\frac{0.48}{16}$ **OR** 0.0225 and 0.03(00) **M2** $\frac{0.0225}{0.0225}$ and $\frac{0.03(00)}{0.0225}$ **OR** 1:1.33 **M3** 1 x 3 and 1.33 x 3 **OR** 3:4 **M4** Pb_3O_4	Division by atomic numbers or upside down calculation scores 0 3:4 ratio without working scores 3 Pb_3O_4 without working scores 4 **ALLOW** ECF from incorrect masses.	4

Question number	Answer	Notes	Marks
(c) (i)	$Pb(NO_3)_2$ (aq) + 2HCl (aq) → $PbCl_2$ (s) + $2HNO_3$ (aq)	**ALLOW** any combination of uppercase and lowercase letters	1
(ii)	• calculate the amount of $PbCl_2$ • multiply the moles by the M_r of $PbCl_2$ • evaluation to show that the value is about 5 g Example calculation **M1** $n(PbCl_2) = \frac{0.0370}{2}$ **OR** 0.0185 (mol) **M2** mass of $PbCl_2$ = 0.0185 x 278 (g) **M3** 5.143 (g)	**MAX 1** for 0.0370 x 278 if no division by 2 in **M1** **ALLOW** any number of sig figs 5.1, 5.14 and 5.143 g without working score 3 5 g without working scores 0 **ALLOW** alternative methods	3
			Total 13

Q15.

Question number	Answer	Notes	Marks
(a)	Any one from: M1 add more limewater (to cover tube on left) M2 the glass tube on the left should be longer/in the limewater		1

(b)	(i)	M1 volume of carbon dioxide = 10 (cm^3) M2 10÷76 × 100 = 13.2 (%)	correct answer with or without working scores 2 marks. **ACCEPT** any number of significant figures except 1 **REJECT** incorrect rounding **ALLOW** ecf on incorrect volume of carbon dioxide **ALLOW** 66/76 x 100 = 86.8 for 1 mark	2
	(ii)	limewater turns (from colourless to) cloudy or milky	**ALLOW** white precipitate	1
	(iii)	M1 the percentage/amount of carbon dioxide in the air is too small M2 therefore the reading on the syringe would change by less than 1 cm^3	**ALLOW** there is 0.04% of carbon dioxide in the air **ALLOW** the change on the gas syringe would be too small **ALLOW** syringe not precise/accurate enough to measure small volume changes	2

(c)	(i)	copper(II) oxide	**ALLOW** copper oxide /CuO **REJECT** copper (I) oxide	1
	(ii)	the powder has a greater surface area (than larger pieces of copper)	**ALLOW** the powder reacts more quickly (than larger pieces of copper)	1
	(iii)	M1 argon/it has a full outer shell of electrons M2 therefore does not lose or gain (or share) electrons	**ALLOW** has eight outer shell electrons	2
				10

Q16.

Question number	Answer	Notes	Marks
(a)	**M1** diamond has a tetrahedral (structure) **OR** in diamond each (carbon) atom is (covalently) bonded to 4 other (carbon) atoms **M2** graphite has a hexagonal (structure) / has layers **OR** in graphite each (carbon) atom is (covalently) bonded to 3 other (carbon) atoms **M3** diamond does not conduct electricity **OR** graphite conducts electricity **M4** diamond has no delocalised electrons **OR** graphite has delocalised electrons **M5** diamond is hard **OR** graphite is soft **M6** in diamond the strong (C-C) bonds need to be broken **OR** in graphite the layers can slide over each other **OR** graphite has weak forces between layers	**REJECT** ions / metallic once in **M1** or **M2** **REJECT** diamond is soft / graphite is hard **REJECT** reference to intermolecular	6
(b)	An explanation that links the following four points: **M1** C_{60} fullerene has weak forces between the molecules /weak intermolecular forces **M2** little / less energy needed to break / overcome the forces /separate the molecules **M3** diamond and graphite have many / strong (covalent) bonds (between atoms) **M4** large amount of /more energy needed to break /overcome the (covalent) bonds	no **M1** or **M2** if reference to breaking bonds in fullerene no **M3** or **M4** if reference to intermolecular forces in diamond and graphite If **M1** and **M3** are not scored allow 1 mark for covalent bonds (in diamond and graphite) need to be broken / overcome **AND** intermolecular forces need to be broken / overcome in fullerene	4 **Total 10**

Q17.

Question number	Answer	Notes	Marks
(a) (i)	measuring cylinder / burette / pipette	**ALLOW** syringe	1
(ii)	**M1** and **M2** all the points correct ± half a square	If only one plotting error scores M1	2
(iii)	2 straight lines of best fit, ignoring the anomalous point	Left line does not have to go through/use (0.0, 10.0) if point has not been plotted	1
(iv)	as the volume of sulfuric acid increases the (electrical) conductivity decreases	**IGNORE** references to gradient/slope/correlation	1
(v)	(the student) forgot to stir the mixture	**ALLOW** any reference to adding less acid/lower volume (than should have done) OWTTE	1
(b) (i)	M1 barium sulfate has a (giant) ionic structure **OR** has ionic bonding		3
	M2 ionic substances do not conduct when solid	**ALLOW** only conduct when dissolved/molten **ALLOW** in solid ions cannot move	
	M3 water has covalent bonding **and** covalent compounds do not (usually) conduct electricity	**ALLOW** water does not conduct because it is covalent **IGNORE** explanations of why covalent do not conduct	
(ii)	filtration **OR** filtering		1
		Total for question = 10 marks	

Q18.

Question number	Answer	Notes	Marks
(a)	name of the part of the atom labelled Z: nucleus number of protons in this atom: 12 number of the group that contains this element: 2 number of the period that contains this element: 3 charge on the ion formed from this atom: 2+	**ACCEPT** +2 / Mg^{2+}	5
(b)	• calculate sum of mass numbers multiplied by percentage abundances • divide answer by 100 • give answer to one decimal place Example calculation **M1** (24 x 79.2) + (25 x 10.0) + (26 x 10.8) **OR** 2431.6 **M2** 2431.6 ÷ 100 **OR** 24.316 **M3** 24.3	**REJECT** if correct working given but incorrectly evaluated **ALLOW** ECF from M1 (24 x 0.792) + (25 x 0.100) + (26 x 0.108) **OR** 24.316 with or without working scores **M1** and **M2** **ALLOW** ECF from M2 if calculated answer is to 1dp	3 **Total 8**

Q19.

Question number	Answer	Notes	Marks
(a)	Any three from: M1 sodium (atom) loses electron(s) M2 oxygen (atom) gains electron(s) M3 sodium loses 1 electron AND oxygen gains 2 electrons OR M3 (both atoms become ions with configuration) 2.8	any mention of sharing of electrons scores 0	3
(b)	62		1
(c)	Any two from: M1 (sodium oxide has) ions / (giant) ionic structure M2 ions / electrons cannot flow / move M3 no delocalised electrons		2
(d)	M1 flame test M2 yellow colour	ALLOW any description of a flame test ALLOW orange or yellow-orange M2 dep on M1 or mention of flame	2
(e)	$2Na_2O \rightarrow 2Na + Na_2O_2$		1
			Total for question = 9 marks

Q20.

Question number	Answer	Notes	Marks
(a) (i)	Any one from: Na K Al In	**ALLOW** names of elements Apply list principle	1
(ii)	Any one from S Cl	**ALLOW** names of elements	1
(b)	same number / three electrons in the outer shell	**ALLOW** valence shell	1
(c)	M1 Xe or xenon M2 as it has a full outer shell (of electrons)	 ALLOW has eight electrons in outer shell ACCEPT does not (easily) gain/lose/share electrons M2 dep on M1	2
(d) (i)	M1 (universal indicator turns) blue or purple M2 because an alkali is produced	 **ACCEPT** OH^- / hydroxide ions are produced **ALLOW** sodium hydroxide is a base / a base is produced	2
(ii)	(similarity) any one from: (both) effervesce melt / turn into a sphere move on surface universal indicator turns the same colour (difference) any one from: potassium gives a lilac flame potassium moves faster potassium effervesces faster	 **ALLOW** fizzes/bubbles **ALLOW** float **ALLOW** both disappear/get smaller/dissolve **ALLOW** faster/more vigorous reaction for potassium **ALLOW** reverse arguments for sodium	2
(iii)	Example calculation M1 (moles of hydrogen) $0.036 \div 2$ **OR** 0.018 mol M2 $0.018 \times 6.0 \times 10^{23}$ **OR** 1.08×10^{22} molecules M3 1.1×10^{22}	correct answer with no working scores 3 marks **ALLOW** ECF M1 $\times 6.0 \times 10^{23}$ **ALLOW** ECF M2 but must be to 2 sig figs 2.16×10^{22} scores 1 2.2×10^{22} scores 2	3
		Total for question = 12 marks	