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SCIENCE



EXAM QUESTION PACK

UNIT C2 HIGHER TIER 5018H PAPERS

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Centre No.						Paper Reference (complete below)								Surname	Initial(s)
Candidate No.										H	/	1	H	Signature	

Paper Reference(s)

5018H/1H 5038H/1H

Edexcel GCSE

Additional Science (5018H)

Chemistry (5038H)

C2 – Topics 5 to 8

Higher Tier

Tuesday 7 June 2011 – Afternoon

Time: 30 minutes

Materials required for examination
Calculator

Items included with question papers
Nil

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature, and complete the paper reference.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Do not use pencil. Use black ink.
Show all stages in any calculations and state the units. Calculators may be used.
Include diagrams in your answers where these are helpful.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 4 questions in this question paper. The total mark for this paper is 30.
There are 12 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You are reminded of the importance of clear English and careful presentation in your answers.

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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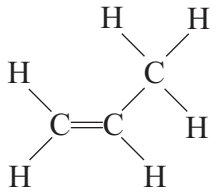
1. One molecule of propane can be cracked to form one molecule of propene, C_3H_6, and one molecule of another gas.

(a) Complete the balanced equation for this reaction.

..... → C_3H_6 + ...

(2)

(b) The structure of a molecule of propene is shown.



(i) Calculate the relative formula mass of propene.
(Relative atomic masses H = 1.0, C = 12)

.....

answer = ...

(1)

(ii) The propene molecule is unsaturated.
Explain why the molecule is said to be unsaturated.

.....

.....

.....

(1)

(iii) Many propene molecules can react together to form a polymer.
Give the name of the polymer formed.

.....

(1)

(iv) When this polymer is manufactured, the reaction has a very high atom economy.
Apart from profit, why is a high atom economy an advantage?

.....

.....

.....

(1)

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(v) Propene reacts with hydrogen chloride to make chloropropane.
The word equation for this reaction is

propene + hydrogen chloride → chloropropane

Ethene reacts with hydrogen chloride in a similar way.
Suggest the name of the product that will be formed by completing the word equation.
The word equation for this reaction is

ethene + hydrogen chloride → .....

(1) **Q1**

(Total 7 marks)

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2. Information about three group 1 metals is given in the table.

element	atomic number	electronic configuration	formula of ion
lithium	3	2.1	Li^+
sodium	11	2.8.1	Na^+
potassium	19	2.8.8.1	K^+

(a) The atomic number of lithium is 3.
What information does this give about the nucleus of a lithium atom?

.....

.....

(1)

(b) Use information in the table to give a reason why these metals are all in group 1 of the periodic table.

.....

.....

.....

(1)

(c) The formula of an oxide ion is O^{2-}.
Using this and the formula for the sodium ion, give the formula of the sodium oxide formed by these ions.

.....

(1)

(d) The reactivity of the elements increases from lithium to potassium.
Explain why, in terms of the electrons in their atoms.

.....

.....

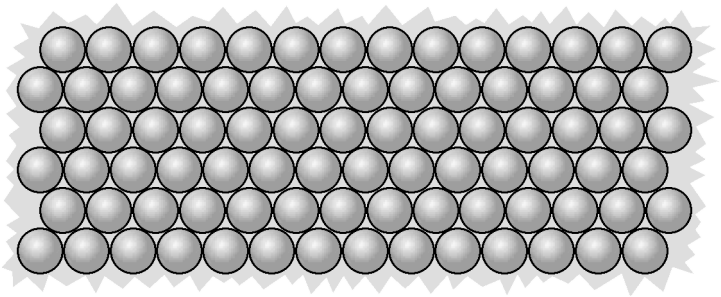
.....

(2)

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(e) Lithium is a metal.
Its structure is



Explain how lithium conducts an electric current.

.....

.....

.....

(2)

(f) An alloy of aluminium and lithium is used to manufacture parts of an aircraft.
Suggest one property this alloy may have that would make it suitable for this use.

.....

.....

(1)

Q2

(Total 8 marks)

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3. Chlorine, Cl_2, is a yellow-green, toxic gas.
The electronic configuration of a chlorine atom is 2.8.7.

(a) Draw a dot and cross diagram to show a chlorine molecule, Cl_2.
Show only the outer shell electrons.

(2)

(b) There are two isotopes of chlorine.

isotope	mass number	abundance
chlorine-35 (^{35}Cl)	35	75%
chlorine-37 (^{37}Cl)	37	25%

(i) In terms of the structures of their atoms, describe the difference between these two isotopes.

.....

.....

(1)

(ii) Use the information in the table to calculate the relative atomic mass of chlorine.
Show your working.

.....

.....

.....

.....

answer = ...

(1)

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(c) Chlorine reacts vigorously with sodium to form sodium chloride, NaCl.

$$2\,Na + Cl_2 \rightarrow 2\,NaCl$$

Sodium chloride is an ionic compound.

(i) Explain how sodium atoms, Na, and chlorine atoms, Cl, react to form sodium ions, Na^+, and chloride ions, Cl^-.

.....

.....

.....

(2)

(ii) The melting point of sodium chloride is 801 °C.
Explain why sodium chloride has such a high melting point?

.....

.....

.....

(2)

(iii) Calculation shows that 2.30 g of sodium reacts with excess chlorine to produce 5.85 g of sodium chloride.
In an experiment, 2.30 g of sodium produced only 3.51 g of sodium chloride.
Calculate the percentage yield of sodium chloride in this experiment.

.....

.....

answer = ...

(1)

Q3

(Total 9 marks)

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4. Each year, more than 300 000 tonnes of ethanol are produced by reacting ethene with steam.

$$C_2H_4 + H_2O \rightleftharpoons C_2H_5OH$$

The reaction is exothermic and can reach a dynamic equilibrium.

(a) Give a use of ethanol other than in alcoholic drinks.

.....

(1)

(b) What is meant by a **dynamic equilibrium**?

.....

.....

.....

.....

(2)

(c) Ethene reacts with steam at 300 °C and under a pressure of about 65 atm.

(i) Using these conditions, the reaction is still slow.
How can the rate of the reaction be increased without changing these conditions?

.....

.....

(1)

(ii) If the reaction is carried out under a higher pressure, the equilibrium yield of ethanol increases.
Explain why.

.....

.....

.....

.....

(2) **Q4**

(Total 6 marks)

TOTAL FOR PAPER: 30 MARKS

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Mark Scheme (Results)

June 2011

360Science

GCSE Additional Science
Structured Paper C2 (5018H/1H)

GCSE Chemistry
Structured Paper C2 (5038H/1H)

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5018H & 5038H Mark Scheme
June 2011

Question Number	Answer	Allow	Reject/ Ignore	Mark
1 (a)	C_3H_8 ; (→ C_3H_6 +) H_2 ;	multiples e.g. 2 C_3H_8 → 2 C_3H_6 + 2 H_2 etc If 1 formula correct scores 1 mark whatever balancing applied; if two formulae correct scores 2 marks only if balancing correct, otherwise 1 mark		**(2)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
1 (b)(i)	3 x 12 + 6 ; (= 42)			**(1)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
1 (b)(ii)	contains (one) double bond / double bonds / >C=C< ;		Ignore spare bonds / references to alkenes Ignore references to carbon not bonded to maximum number of hydrogens	**(1)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
1 (b)(iii)	poly(propene);	polypropene	Incorrect spelling	**(1)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
1 (b)(iv)	little or no waste / little by-products / high % reactants end up as products ;	High output compared to low input	Reject references to yield / quantity produced / energy / environment	**(1)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
1 (b)(v)	chloroethane ;		chloroethene	**(1)**

Question Number	Answer	Allow	Reject	Mark
2 (a)	number of protons / contains 3 protons;		any other number of protons /references to neutrons or electrons	**(1)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
2 (b)	they have **one** electron in the outer shell / all form +**1** ion / all lose **one** electron / electronic configuration ends in **one** ;			**(1)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
2 (c)	Na_2O / $Na^+_2O^{2-}$;	ONa_2, $(Na^+)_2O$		**(1)**

Question Number	Answer	Allow	Ignore	Mark
2 (d)	1. outer electron shielded from nucleus by more electrons /more shells/more shielding/outer shell electron further away from nucleus ; 2. **outer** electron more easily lost / less attractive force on **outer** electron ;		more outer shells	**(2)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
2 (e)	1. {free/delocalised/sea of} electrons ; 2. electrons {move / flow} ;			**(2)**

Question Number	Answer	Allow	Ignore	Mark
2 (f)	low density / strong / lightweight /corrosion resistant ;		light / malleable / hard / high melting point / rigid	**(1)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
3 (a)	1. shared pair ; 2. rest of diagram correct (consequential on first mark) ;	any combination of dots or crosses	Ignore inner shells Symbols not required but if given must be correct for second mark	**(2)**

Question Number	Answer	Allow	Reject/ ignore	Mark
3 (b) (i)	different number of neutrons / two more neutrons in chlorine 37/ chlorine 35 contains 18 neutrons **and** chlorine 37 contains 20 neutrons ;		ignore references to mass number / abundance reject incorrect references to protons and electrons	**(1)**

Question Number	Answer	Allow	Reject	Mark
3 (b) (ii)	$\frac{(35 \times 75) + (37 \times 25)}{100}$; (= 35.5) (other working acceptable)	any correct working producing 35.5	35.5 with no working	**(1)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
3 (c) (i)	1. one electron is transferred ; 2. from Na(atom)to Cl (atom) ;	sodium loses an electron and chlorine gains an electron = 2	Any reference to covalent bonding scores 0	**(2)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
3 (c) (ii)	Any from the following 1. strong (electrostatic) forces (between ions); 2. large amounts of {energy / heat} required (to break bonds) ;	bonds /particles	reject intermolecular forces / atoms / covalent bonds for point 1 ignore 'bonds hard to break' / references to temperature	**(2)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
3 (c)(iii)	3.51 x 100 ; (= 60%) 5.85	60% with no working		**(1)**

Question Number	Answer	Allow	Reject/ Ignore	Mark
4 (a)	fuel / solvent / to make perfumes / sterilising /sanitising gels/ making esters / disinfectant / cleaning wounds / biofuel		Ignore vague answers such as cleaning products (unspecified), petrol, cosmetics, biodiesel	**(1)**

Question Number	Answer	Allow	Ignore	Mark
4 (b)	1. both forward and back reactions occurring / (reaction) reversible ; 2. (both reactions) occur at the same rate ; 3. the {amounts of substances present / concentrations } are unchanged	(forward and back) reactions cancel	References to yield	**(2)**

Question Number	Answer	Allow	Reject	Mark
4 (c) (i)	by using a (suitable) catalyst /phosphoric acid;		any other named catalyst / changes in conditions	**(1)**

Question Number	Answer	Allow	Ignore	Mark
4 (c) (ii)	1. forward reaction favoured/ equilibrium moves to right ; 2. takes place with a decrease in the total number of {molecules / particles} / volume ;		any references to rate ignore references to numbers of atoms	**(2)**

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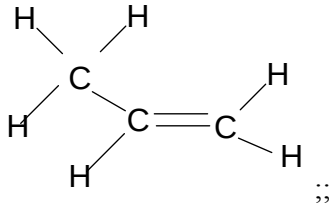
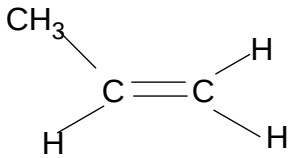
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Additional Science 5018H/1H
Chemistry 5038H/1H
C2 Mark Scheme

Question Number	Answer	Mark
1(a)(i)	**Need two points:** **-Idea of chain** large molecule / chain / 'repeating' or 'joining' (unit of some sort) **-Second idea** made from (small) molecules / alkenes / monomers / hydrocarbons / small chain (molecules) ; [Ignore references to plastic]	**(1)**

Question Number	Answer	Mark
1(a)(ii)	only **one** type of (single) monomer / only **one** product / made from alkene;	**(1)**

Question Number	Answer	Mark
1(b)	 ;; allow  (note: H_3 – C bond as shown above is allowed) Allow molecule with **one** C=C bond (carbons do not have to be tetravalent) for one mark (molecule can have any number of carbons); [Allow correct dot and cross diagram Molecules with no double bonds will score zero]	**(2)**

Question Number	Answer	Mark
1(c)	**First mark:** >C=C< bond breaks / double bond(s) break / opens up / OWTTE ; **Second mark – dependent on first being awarded:** then form new (covalent) bond / molecules then bond / join / form chain / link ; [Ignore 'combine' here]	**(2)**

Question Number	Answer	Mark
1(d)	any **two** of: • melts or softens ; • molecules would slide or move or separate ; [Ignore particles/ atoms] • no or weak cross-links or inter-molecular forces (between molecules) ; [Allow 'bonds' ONLY if it is absolutely clear they are inter-molecular eg - 'weak bonds' NO, - 'weak bonds between molecules' YES - 'no intermolecular bonds' YES] [Ignore idea of bonds/ forces breaking or weakening] [Allow layers/ chains instead of molecules]	**(2)**

Question Number	Answer	Mark
1(e)	conserves resources / oil / energy / prevents waste or rubbish / cuts down landfill use / cuts down CO_2 release if they are burnt instead / new polymer articles can be made / slow degradation / non-biodegradable ; [Ignore 'better for environment' 'prevents pollution' etc as too vague]	**(1)**

Question Number	Answer	Mark
2(a)	11 (p) 12 (n) 11 (e) ;; Allow 2 correct for one mark;	**(2)**

Question Number	Answer	Mark
2(b)(i)	**One** electron (transferred); From Na to Cl / Na loses and Cl gains;	**(2)**

Question Number	Answer	Mark
2(b)(ii)	ionic / electrovalent ;	**(1)**

Question Number	Answer	Mark
2(c)	Any **two** of • strong forces / bonds / electrostatic attraction / bonds hard to break ; [Reject strong intermolecular forces] • between ions / ionic bonding / ionic bonds; [Ignore atoms / molecules here] • a lot of heat / energy needed ; [Ignore 'high temperature needed'] [Allow one mark maximum if covalent bonding or intermolecular forces mentioned eg 'strong covalent bonds' scores 1; 'strong covalent bonds need a lot of energy to break' also just 1 only]	**(2)**

Question Number	Answer	Mark
3(a)(i)	2, 8, 8 ; [Allow 2 8 8 / 2-8-8 etc or correct diagram]	**(1)**

Question Number	Answer	Mark
3(a)(ii)	**Any two from:** unreactive (accept not very reactive) / stable ; full outer shell / 8 electrons in outer shell ; stops filament evaporating / reacting / burning / oxidising / replaces or excludes air or oxygen ; Ignore references to conduction of electricity	**(2)**

Question Number	Answer	Mark
3(b)	20.2;; [Allow 20.182 for 1 mark] working with incorrect final answer scores 1: $\frac{(20 \times 90.90) + (22 \times 9.10)}{100}$	**(2)**

Question Number	Answer	Mark
4(a)	**First mark for WEAK forces:** Weak forces / bonds (between molecules); [Reject weak covalent, ionic or intramolecular bonds] **Second mark dependant on first – for intermolecular or energy:** between (N_2)molecules / intermolecular / requires little energy to overcome; 'Weak bonds' = 0, 'weak forces between atoms' = 0 as we assume these are N≡N bonds unless otherwise specified	**(2)**

Question Number	Answer	Mark
4(b)	3 x shared pair of electrons between N and H (3 covalent bonds); lone pair / remaining 2 electrons on N outer shell; [Notes: -as long as numbers of electrons correct, allow any combination of dots and crosses -element symbols not required -can only score 2 marks if fully correct -if inner shells shown incorrectly, penalise a 2 mark answer, but not a 1 mark answer]	**(2)**

Question Number	Answer	Mark
4(c)	**Mark for yield:** yield decreases / less ammonia / product; [Ignore references to reactant for this mark] **Movement of equilibrium mark (does not depend on first mark):** Equilibrium 'moves left' / gives more reactant / endothermic reaction favoured ; [Ignore 'reaction would reverse', 'reaction becomes endothermic'] [Ignore rate arguments]	**(2)**

Question Number	Answer	Mark
4(d)	increase rate (of attainment of equilibrium) /to speed up reaction /a lower temperature can be used / more (frequent) successful collisions; Allow lowers activation energy;	**(1)**

Question Number	Answer	Mark
4(e)	NH_3 + HNO_3; → NH_4NO_3; [reactant formulae; product formula; If formulae correct but unbalanced scores maximum 1]	**(2)**

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5018H / 5038H/ 1H (C2) Mark Scheme

Question Number	Answer	Mark
1(a)(i)	heat/ high temperature/ catalyst (can be specified); Ignore pressure	**(1)**

Question Number	Answer	Mark
1(a)(ii)	alkene ; Ignore named alkenes	**(1)**

Question Number	Answer	Mark
1(a)(iii)	contains C=C/ double bond/ not bonded with the maximum number of atoms or groups/ triple bond; Ignore spare bonds	**(1)**

Question Number	Answer	Mark
1(b)	molecule **B** with explanation: contains more (than one) C=C or double bond/ 2 double bonds;	**(1)**

Question Number	Answer	Mark
1(c)(i)	weaker (inter-molecular forces) (in polyunsaturates) / ORA ;	**(1)**

Question Number	Answer	Mark
1(c)(ii)	hydrogen/ H_2 ;	**(1)**

Question Number	Answer	Mark
1(d)(i)	(biological) catalyst/ controls reactions; Ignore references to break down of food (in question)	**(1)**

Question Number	Answer	Mark
1(d)(ii)	Lack of food breakdown, energy release etc **leads to** explained impact on body/ body systems shut down/ metabolism slows OWTTE ; Ignore references to disease fighting/ bacteria etc	**(1)**

Question Number	Answer	Mark
2(a)	1. 9 protons in **nucleus**; 2. 10 neutrons in **nucleus**; 3. 9 electrons in shells /orbits /around nucleus; OR 1. Three sub-atomic particles named; 2. Particles in correct places in atom; 3. Numbers of each particle;	**(3)**

Question Number	Answer	Mark
2(b)(i)	atom / particle/ group of atoms that has gained/ lost electron(s)/ has a (positive/ negative) charge;	**(1)**

Question Number	Answer	Mark
2(b)(ii)	CaF_2 ; Reject CA instead of Ca Reject F2 or CaF^2 instead of F_2	**(1)**

Question Number	Answer	Mark
2(b)(iii)	$Ca + F_2 \rightarrow CaF_2$; Accept multiples Ignore state symbols Reject word equations and incorrect symbols eg CA, F2	**(1)**

Question Number	Answer	Mark
3(a)	Carbon can form carbon-carbon bonds in a chain/ forms stable/ strong (covalent) bonds;	**(1)**

Question Number	Answer	Mark
3(b)	tests to confirm findings/ further experiments/ test new substance to see if new/ research to check other scientists' work;	**(1)**

Question Number	Answer	Mark
3(c)(i)	Layers or similar (of ions/ atoms), atoms or ions can slide or move/ ions can move in sea of electrons; [Reject any answer involving molecules or covalent bonding]	**(1)**

Question Number	Answer	Mark
3(c)(ii)	sea/ delocalised/ free electrons can move; [Reject spare electrons or ion movement / covalent bonding]	**(1)**

Question Number	Answer	Mark
3(d)(i)	1. shared electrons; 2. two (electrons)/ pair; [Note: carefully explained multiple bonds can score both marks]	**(2)**

Question Number	Answer	Mark
3(d)(ii)	1. layers/ sheets/ plates (of carbon atoms); 2. arranged in hexagons/ each carbon forms 3 bonds; 3. delocalised electrons/ sea of electrons / free electrons or electrons can move; [Marks could be scored from diagram]	**(3)**

Question Number	Answer	Mark
4(a)(i)	$2\ H_2O_2 \rightarrow 2\ H_2O + O_2$;; formulae; balancing of correct formulae; Ignore state symbols, accept multiples Reject words	**(2)**

Question Number	Answer	Mark
4(a)(ii)	**Temperature mark** 1. heat to required temperature/ surround by water bath at required temperature/ measure temperature (of solution); **Volume/time reading mark** 2. after fixed time(s) take volume reading/ measure time to produce given volume/ take time for gas to stop evolving; **Further experiment mark** 3. repeat at different temperatures/ repeat to check results;	**(3)**

Question Number	Answer	Mark
4(b)	1. X / Y not catalyst(s) because time similar; 2. Z (best) catalyst become faster/ shorter time; X and Z (catalysts) as time reduced scores 1 only	**(2)**