OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry B

General Certificate of Secondary Education

Unit **B642/02:** Modules C4, C5, C6 (Higher Tier)

Mark Scheme for June 2011

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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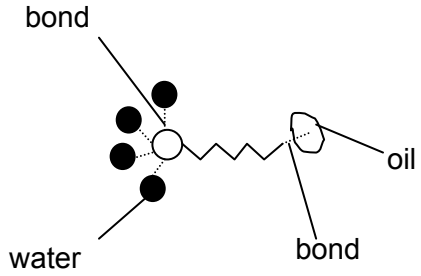
The **Abbreviations, annotations and conventions** used in the detailed Mark Scheme are:

/	=	alternative and acceptable answers for the same marking point
(1)	=	separates marking points
not	=	answers which are not worthy of credit
reject	=	answers which are not worthy of credit
ignore	=	statements which are irrelevant
allow	=	answers that can be accepted
( )	=	words which are not essential to gain credit
__	=	underlined words must be present in answer to score a mark
ecf	=	error carried forward
AW	=	alternative wording
ora	=	or reverse argument

Question			Expected Answers	Marks	Additional Guidance
1	a		saves energy / can wash delicate clothes / colour does not become paler (1)	1	**allow** reduces the carbon footprint / less greenhouse gases / less global warming / aw **allow** clothes will not lose colour / clothes will not shrink / clothes will not be damaged **allow** enzymes are not denatured **ignore** reference to cost **ignore** reference to environmentally friendly
	b	i	Drawing showing hydrophobic tail and hydrophilic head labelled (1)	1	**allow** polar head and non-polar tail 
		ii	hydrophobic end of detergent molecule is attracted to oil or stain / hydrophobic end forms intermolecular forces with oil or stain / hydrophobic end bonds to oil or stain (1) hydrophilic end of detergent is attracted to water / hydrophilic end forms intermolecular forces with water / hydrophilic end bonds to water to oil or stain (1)	2	**if no other marks awarded** **allow** tail is surrounded by oil molecules and the head by water molecules **allow** as alternative to bonds sticks to, attached, joined the hydrophobic end sticks into oil is **not** sufficient **all** marks can be awarded from a **labelled** diagram but to get two marks must clearly show bonding to rather than surrounded by 
	c		does not use water (1)	1	**ignore** it does not get wet
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
2	a		Na_2SO_4 (1)	1	**allow** any order of atomic symbols
	b		it contains chloride (ions) / reaction with chloride (ions) / formation of silver chloride (1)	1	**allow** sea water contains sodium chloride **not** reaction with chlorine (ions)
	c		potassium chloride + barium sulfate (1)	1	**allow** KC*l* + $BaSO_4$ **allow** mix of name and correct formula **allow** products in any order **both** required for the mark
	d	i	needs lots of energy (to boil the water) / aw (1)	1	**allow** the cost of energy is high **allow** needs lots of heat it needs a high temperature is **not** sufficient
		ii	(prevents death) from water borne diseases / aw (1)	1	**allow** named disease such as cholera and dysentery **allow** can die from disease (in water) / dirty water contains harmful bacteria / dirty water contains pathogens **allow** clean water reduces infections or diseases **ignore** to survive / prevents illness / might die / to stay healthy
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	reaction is faster / can make more in a shorter time / have to pay for other costs for less time (1)	1	
		ii	can be automated / employing fewer workers / aw (1)	1	**allow** it is much easier to recycle materials / aw **allow** reaction does not have to be started and stopped / less downtime / no cleaning to be done between processes **ignore** there are less waste products
		iii	no need to pay for pollution control / higher percentage yield (1)	1	**allow** raw materials easier to get hold of / no waste products **ignore** references to cost
	b		**any two from:** plant is crushed / plant is ground down (1) use of a solvent / use of named solvent (1) distillation (1) chromatography (1)	2	 **allow** cut the plant / squeeze the plant **allow** dissolve in water / steam (with water) / boil with water
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
4	a		35 (%) (1)	1	
	b		**any two from:** provides nitrogen / replaces nitrogen used up in soil (1) (nitrogen) gets used by plant to make plant proteins (1) plant proteins needed for growth (1)	2	**not** contains potassium or phosphorus **not** provides protein **allow** nitrogen used to make amino acids / nitrogen used to make polypeptides **allow** amino acids or polypeptides needed for growth
	c		ammonia / ammonium hydroxide **and** phosphoric (acid) (1)	1	**both needed** **allow** ammonium carbonate / $(NH_4)_2CO_3$ **allow** NH_3 / NH_4OH and H_3PO_4 **allow** acid-ammonia **and** alkali-phosphoric <u>acid</u> **not** phosphorus (acid) **not** ammonium / ammonia hydroxide
	d		60 (1)	1	
			Total	**5**	

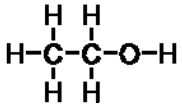
Question			Expected Answers	Marks	Additional Guidance
5	a		CH_3COOK (1)	1	**allow** other ways of indicating correct response eg ringing or ticking the correct answer
	b	i	3.7 (1)	1	**allow** any value between 3.6 and 3.8
		ii	24 (cm^3) (1)	1	
	c		methyl orange changes colour while it is still acid / methyl orange will not change colour at neutralisation / aw (1) phenolphthalein will change colour at the neutralisation point / aw (1)	2	**allow** methyl orange will not change colour at pH 7 **allow** methyl orange changes colour somewhere between pH 1.1 and pH 3.9 (allow a specific pH value within this range) **allow** phenolphthalein changes colour somewhere between pH 7.1 and pH 9.9 (allow a specific pH value within this range)
			Total	**5**	

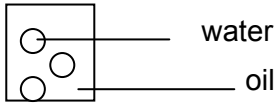
Question			Expected Answers	Marks	Additional Guidance
6	a		$C_2H_2O_4$ (1)	1	**allow** any order of atomic symbols **not** C2H2O4 / $C^2H^2O^4$
	b		H^+ (1)	1	**allow** other ways of indicating correct response e.g. ringing or ticking the correct answer
	c		will react with metal / will react with the element / corrodes the kettle (1)	1	**allow** strong(er) acid / it is strong(er) / it has too low a pH the kettle, metal or element is damaged is not sufficient **ignore** it is toxic / erode
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
7	a		greater concentration of product (than reactant) / ora (1)	1	**allow** more product than reactant / ora **not** more products made (than reactants)
	b		800 ^{o}C position of equilibrium moves to the left (1) 100 ^{o}C reaction is too slow (1)	2	**allow** the higher the temperature the lower the yield / as the temperature increases the position of equilibrium moves to the left / ora **allow** the lower the temperature the slower the reaction / ora **allow** 450 ^{o}C is the optimum temperature / because it gives a reasonable rate of reaction without shifting position of equilibrium to the left for one mark if no other mark has been awarded
	c		vanadium(V) oxide (1)	1	**allow** other ways of indicating correct response eg ringing or ticking the correct answer
	d		sulfur + oxygen → sulfur dioxide (1)	1	**allow** S + O_2 → SO_2 even if it is not balanced
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
8	a		$4OH^- - 4e^- \rightarrow O_2 + 2H_2O$ correct reactants and products including electrons (1) balancing – dependent on correct formulae (1)	2	**allow** $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$ **allow** one mark for correctly balanced equation with minor errors with case eg $4OH^- – 4e- \rightarrow O_2 + 2H_2O$ n.b. this equation scores 0 marks $4OH^- + 4e^- \rightarrow O_2 + 2H_2O$
	b	i	amount (directly) proportional to time / as time increases amount increases / ora (1)	1	**not** as time increases oxygen is produced faster
		ii	amount (directly) proportional to current / as current increases amount increases / ora (1)	1	**ignore** as current increases oxygen is produced faster
	c		3000 (1)	1	
	d		Moles of KO_2 = 1 and moles of O_2 = 0.75 / 284 g of KO_2 make 96 g of O_2 (1) mass of O_2 = 24 (g)	2	**allow** full marks for 24 with no working out mark answer line first and ignore incorrect working out
			Total	**7**	

Question			Expected Answers	Marks	Additional Guidance
9	a		**any two from:** zinc reacts instead of iron (1) zinc is more reactive (than iron) / ora (1) zinc loses electrons more easily (than iron) / ora (1)	2	**allow** zinc oxidises instead of iron **allow** zinc is a better reducing agent
	b		$Fe \rightarrow Fe^{2+} + 2e^{-}$ / $Fe - 2e^{-} \rightarrow Fe^{2+}$ correct symbols (1) correct balancing (1)	2	**allow** any correct multiple **allow** 1 mark for correctly balanced equation with minor errors of case or subscripts e.g. Fe → FE2+ + 2e- **allow** = instead of arrow **ignore** state symbols **not** and for + n.b. these equations score 0 marks $Fe \rightarrow Fe^{2+} - 2e^{-}$ / $Fe + 2e^{-} \rightarrow Fe^{2+}$
	c		zinc + copper sulfate → copper + zinc sulfate (1)	1	**allow** = instead of → but **not** and / & **allow** correct formulae but **ignore** balancing **/** $Zn + CuSO_4 \rightarrow Cu + ZnSO_4$ **allow** mix of correct formulae and words
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
10	a		ethanol is  (1)	1	**allow** displayed formula with no bond shown between O and H
	b		C_4H_9OH (1)	1	**allow** $C_4H_{10}O$
	c		**any two from:** (much cheaper because) it is a continuous process (1) atom economy is 100% / no waste product (1) obtain pure ethanol / ethanol needs to be separated from reaction mixture in fermentation (1) in UK crude oil is easily available (1) hydration is a fast process / hydration takes a short time (1)	2	**allow** does not need lots of land / does not need a hot climate / United Kingdom does not grow sugar cane / sugar cane would need to be imported for one mark **allow** ethene is easily available
	d		$C_2H_4 + H_2O \rightarrow C_2H_5OH$	1	**allow** $C_2H_4 + H_2O \rightarrow C_2H_6O$ **allow** any correct multiple **allow** symbol for reversible reaction or = instead of arrow **ignore** state symbols **not** and for +
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
11	a	i	(compound **B**) has a (carbon-carbon) double bond	1	
		ii	bromine (water) (1) goes red-brown to colourless / yellow to colourless / decolourised (1)	2	**allow** 2 marks for bromine water is decolourised **ignore** goes clear **allow** any shade of brown **allow** goes colourless **not** goes discoloured
	b		saponification (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line blank.
	c		In box  small circles / droplets labelled water rest of space labelled oil (1)	1	**allow** any number of water droplets
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
12	a		exothermic (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line blank.
	b		reactants / H_2 + O_2 / hydrogen + oxygen (1)	1	**not** H and O
	c		at electrode **A** electrons are lost so it is oxidation **and** at electrode **B** electrons are gained so it is reduction (1)	1	**both** electrodes must be referred to for 1 mark electrode **A** may be referred to as the hydrogen electrode and electrode **B** may be referred to as the oxygen electrode
	d		**any two from:** fuel cells are **more** efficient (1) fuel cells are light**er** than batteries (1) fuel cells can be used continually / fuel cells do not need to be charged (1) fuel cells use the same fuel that propels the rocket (1) fuel cells produce water that can be used to drink (1)	2	**allow ora** if batteries are specified **ignore** more energy is produced **allow** fuel cells do not run out / fuel cells last longer / fuel cells do not need to be replaced **not** reference to pollution
			Total	**5**	

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