

Chemistry B

General Certificate of Secondary Education

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

Mark Scheme for January 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.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	=	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
<u> </u>	=	underlined words must be present in answer to score a mark
ecf	=	error carried forward
AW	=	alternative wording
ora	=	or reverse argument

B642/02

Mark Scheme

January 2011

Question		Expected Answers	Marks	Additional Guidance
1	(a)	carbon monoxide + methanol \rightarrow ethanoic acid (1)	1	allow mixture of correct formulae and names allow $\text{CO} + \text{CH}_3\text{OH} \rightarrow \text{CH}_3\text{COOH}$ allow = in equation not & or and or + energy
	(b)	any two from: (use of a) catalyst increases the rate of reaction (1) reactants are recycled (1) catalyst is not used up / catalyst is recycled (1) (continuous process) so can be automated (1)	2	allow use a lower temperature / use a lower pressure / use less heat energy
	(c) (i)	increases / goes up (1)	1	
	(ii)	decreases / goes down (1)	1	
		Total	5	

B642/02

Mark Scheme

January 2011

Question		Expected Answers	Marks	Additional Guidance
2	(a)	9 (1)	1	
	(b) (i)	149 (1)	1	
	(ii)	20.8 (%) (1)	1	allow ecf from wrong M_r in (i) allow 21%
	(c)	$\text{AgNO}_3 + \text{KI} \rightarrow \text{KNO}_3 + \text{AgI}$ (1)	1	allow $\text{Ag}^+ + \text{I}^- \rightarrow \text{AgI}$ allow correct multiples allow = not and or & in equation ignore state symbols
	(d)	$\frac{1.68}{2.24} \times 100$ (1) but 75 (2)	2	allow $\frac{am}{pm} \times 100$ for one mark if answer incorrect allow full marks for 75% with no working out
		Total	6	

B642/02

Mark Scheme

January 2011

Question		Expected Answers	Marks	Additional Guidance														
3	(a)	ammonium phosphate and sodium nitrate (1)	1	allow $(\text{NH}_4)_3\text{PO}_4$ and NaNO_3														
	(b)	<table border="1" data-bbox="471 309 887 770"> <thead> <tr> <th>statement</th><th>number</th></tr> </thead> <tbody> <tr><td>aquatic animals in the river die</td><td>6</td></tr> <tr><td>algal bloom blocks sunlight</td><td>3</td></tr> <tr><td>other green plants in the river die and aerobic bacteria feed off dead plants</td><td>4</td></tr> <tr><td>concentration of nitrate ions in river water increases so algae grow rapidly</td><td>2</td></tr> <tr><td>rain washes away fertiliser from fields</td><td>1</td></tr> <tr><td>concentration of oxygen in the river water decreases</td><td>5</td></tr> </tbody> </table> <p>correct order (2)</p>	statement	number	aquatic animals in the river die	6	algal bloom blocks sunlight	3	other green plants in the river die and aerobic bacteria feed off dead plants	4	concentration of nitrate ions in river water increases so algae grow rapidly	2	rain washes away fertiliser from fields	1	concentration of oxygen in the river water decreases	5	2	allow one mark for correct order with two in the wrong place
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aquatic animals in the river die	6																	
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	(c)	ammonia and phosphoric acid (1) titration / description of titration (1) use a pH meter to show when pH is 7 / add until a named indicator changes colour (1)	3	allow H_3PO_4 and $\text{NH}_3 / \text{NH}_4\text{OH}$ not ammonium allow ammonium hydroxide allow adding ammonia or phosphoric acid in a controlled way eg dropping from a teat pipette ignore wrong colour change of indicator ignore universal indicator ignore evaporation if included after neutralisation														
		Total	6															

B642/02

Mark Scheme

January 2011

Question		Expected Answers	Marks	Additional Guidance
4	(a)	<p>idea that the structure has many bonds that can be broken / lots of strong bonds / is a giant structure / needs lots of energy to break the bonds (1)</p> <p>but</p> <p>idea that there are many, strong bonds to be broken which needs lots of energy / has a giant structure with strong bonds that need lots of heat to break (2)</p>	2	<p>This is a level of response mark scheme</p> <p>allow reference to covalent bonds instead of strong bonds but not ionic bonds</p> <p>ignore high temperature</p>
	(b)	(very) hard (1)	1	<p>allow is a good conductor of heat</p> <p>ignore rigid / strong</p>
Total			3	

Question		Expected Answers	Marks	Additional Guidance
5	(a)	NaO (1)	1	allow correct answer ticked, circled or underlined in list if answer line blank
	(b)	evidence that 1.95 is one quarter of 7.8 (1) 0.4 (g) (1)	2	allow full marks for correct answer on the answer line whether or not there is any working out
	(c)	carbon-12	1	
Total			4	

B642/02

Mark Scheme

January 2011

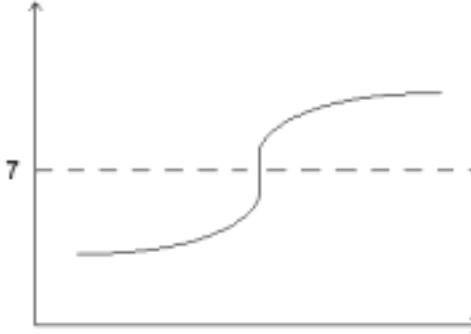
Question			Expected Answers	Marks	Additional Guidance
6	(a)	(i)	64 (cm ³) (1)	1	
		(ii)	$\frac{40}{24000}$ (1) moles = 0.00167 (1)	2	allow 2 sig figs or more eg 0.0017 / 0.001666667 allow ecf from wrong volume for the second mark
		(b)	reactant that is used up first (1)	1	allow the reactant that is not in excess
		(c)	does not completely dissociate / does not completely ionise (1) has hydrogen ions / has a pH between 3 to 6.99 (1)	2	allow forms an equilibrium mixture allow pH less than 7
			Total	6	

Question			Expected Answers	Marks	Additional Guidance
7	(a)	(i)	0.88 (g) (1)	1	
		(ii)	(mass) increases (1)	1	allow directly proportional to the time
		(iii)	(mass) increases (1)	1	allow directly proportional to the current
	(b)		Cu → Cu ²⁺ + 2e ⁻ / Cu – 2e ⁻ → Cu ²⁺ correct reactants and products (1) balanced equation (1)	2	allow any correct multiple allow = or ⇌ not and or & balanced equation mark dependent on correct formulae but allow one mark for balanced equation with minor errors in formulae eg CU → Cu ²⁺ + 2e ⁻
			Total	5	

B642/02

Mark Scheme

January 2011

Question		Expected Answers	Marks	Additional Guidance
8	(a)	starting pH below 7 and finishing pH above 7 (1) general shape correct including an almost vertical section centred around pH 7 (1)	2	
	(b)	0.00375 (1)	1	
	(c) (i)	neutralisation indicated by the sudden change of colour / when (one drop makes) indicator change colour / (one drop makes) the indicator go from red to blue (1)	1	allow at point of neutralisation litmus changes from red to blue
	(ii)	does not have a sudden change of colour / gives a continuous colour change (1)	1	allow is a mixed indicator
		Total	5	

B642/02

Mark Scheme

January 2011

Question		Expected Answers	Marks	Additional Guidance
9	(a)	(i) prevent formation of ethanoic acid (1)	1	to stop ethanol reacting with oxygen or to prevent oxidation of the ethanol is not sufficient (1) allow prevent formation of vinegar
	(ii)	at 0°C yeast inactive / reaction rate too slow (1) at 70°C temperature too high enzyme denatured / changes shape of active site / yeast killed (1)	2	it will not work is not sufficient allow it is not very active allow enzyme is inactive not yeast denatured / enzyme killed
	(b)	ethene + water → ethanol (1)	1	allow = instead of → but not and / & allow steam instead of water allow $C_2H_4 + H_2O \rightarrow C_2H_6O$ / word equation with mix of correct formulae and words and ignore incorrect balancing .
		Total	4	

B642/02

Mark Scheme

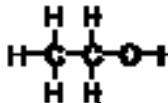
January 2011

Question		Expected Answers	Marks	Additional Guidance
10	(a)	redox (1)	1	
	(b)	any two from: zinc (acts as a barrier) to prevent water reaching iron / (barrier) to prevent oxygen reacting iron / (barrier) to prevent air reacting (1) zinc acts as a sacrificial metal / zinc reacts instead of iron (1) zinc is more reactive (than iron) / ora zinc loses electrons more easily (than iron) / ora (1)	2	ignore zinc rusting
		Total	3	

B642/02

Mark Scheme

January 2011

Question		Expected Answers	Marks	Additional Guidance
11	(a)	<p>ethanol is</p>  <p>(1)</p> <p>paracetamol is $C_8H_9NO_2$ (2)</p>	3	<p>allow any order of symbols</p> <p>if there is any error in counting atoms allow one mark if one error and no marks if two errors eg $C_8H_8O_2N$ (1), C_8H_9ON (1) but $C_8H_8O_2$ (0)</p> <p>if a molecular formula is not written allow one mark if all the atom counting is correct eg C_8H_9ONO (1) and C_8H_8NOOH (1)</p> <p>if an atom counting error and a formula error then 0 marks eg C_8H_8ONO</p>
	(b)	change the molecule from covalent to ionic / make the $-COOH$ group into the $-COO^-$ ion (1)	1	allow make the sodium salt / structure has a Na^+
	(c)	salicylic acid (1)	1	allow correct answer ticked, circled or underlined in list if answer line blank.
Total			5	

Question		Expected Answers	Marks	Additional Guidance
12		calcium hydrogencarbonate (1)	1	<p>allow correct answer ticked, circled or underlined in list if answer line blank.</p> <p>allow $Ca(HCO_3)_2$</p>
Total			1	

B642/02

Mark Scheme

January 2011

Question			Expected Answers	Marks	Additional Guidance
13	(a)	(i)	chlorine (1)	1	
		(ii)	$2H^+ + 2e^- \rightarrow H_2$ correct symbols (1) correct balancing (1)	2	allow $H^+ + e^- \rightarrow H$ for one mark allow $H^+ + e^- \rightarrow H$ followed by $H + H \rightarrow H_2$ (2) balanced equation mark dependent on correct formulae but allow one mark for balanced equation with minor errors in formulae eg $2H^+ + 2e^- \rightarrow H_2$
	(b)		exothermic (1)	1	allow correct answer ticked, circled or underlined in list if answer line blank.
Total				4	

Question			Expected Answers	Marks	Additional Guidance
14	(a)		bromine (water) (1) red/brown / yellow to colourless (1)	2	allow 2 marks for bromine water is decolourised ignore goes clear
	(b)		saponification (1)	1	allow correct answer ticked, circled or underlined in list if answer line blank.
Total				3	

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