AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Education

Applied Science 8771/8773/8776/8779

SC11   Controlling Chemical Processes

Mark Scheme

2007 examination - January series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Question 1

(a)	Homogeneous	(1)(AO1)	**1**
(b)	[29.8] − [82.9 + 52.3] − 105.4 kJ mol^{-1}	(1)(AO2) (1)(AO2) (1)(AO2)	**3**
(c)	<u>All reactants</u> added at start <u>Once reaction is over</u>, products removed	(1)(AO1) (1)(AO1)	**2**
(d)(i)	78 106	(1)(AO1) (1)(AO1)	**2**
(ii)	(200/106) x 78 Ans 147.2 kg ecf /allow 147	(1)(AO2) (1)(AO2)	**2**
(e)	Increases rate Particles have more energy Hence <u>more</u> effective/successful collisions / <u>more</u> particles with energy≥ Ea	(1)(AO1) (1)(AO2) (1)(AO2)	**3**
(f)	Incomplete reaction Other products formed	(1)(AO2) (1)(AO2)	**2**
(g)	(320/392.5) x 100 81.5%	(1)(AO2) (1)(AO2)	**2**

Total Mark: 17

Question 2

(a)	$3O_2$ $2CO_2$ $3H_2O$ 3 ✓ = 2 marks 2✓ = 1 mark	(1)(AO1) (1)(AO1)	**2**
(b)	Balance / scales Suitable container for water / beaker / calorimeter Thermometer Measuring cylinder ANY 3 Mass of alcohol Mass of water Temperature rise Any accuracy aspects e.g. stir Max 6	(1)(AO3) (1)(AO3) (1)(AO3) Max 3 (1)(AO3) (1)(AO3) (1)(AO3) Max 3	**6**
(c)	Mass of water and temperature rise in equation Q = mc△t Q/ moles of alcohol	(1)(AO2) (1)(AO2) (1)(AO2)	**3**
(d)	Heat losses Incomplete combustion	(1)(AO2) (1)(AO2)	**2**

Total Mark: 13

Question 3

(a)	Alters rate of reaction Unchanged at end <u>Not</u> doesn't take part	(1)(AO1) (1)(AO1)	**2**
(b)	Vertical axis <u>number of</u> particles Horizontal axis energy	(1)(AO1) (1)(AO1)	**2**
(c)	Minimum energy For reaction to occur / start / successful collision	(1)(AO1) (1)(AO1)	**2**
(d)	Lower Ea More particles with energy greater than Ea	(1)(AO2) (1)(AO2)	**2**
(e)	Larger surface area Less needed – therefore cheaper Not cheaper	(1)(AO2) (1)(AO2)	**2**
(f)	Make more of the surface area available <u>Not</u> more surface area	(1)(AO2)	**1**
(g)	$K_c = [SO_3]^2/[SO_2]^2[O_2]$ Fraction Indices	 (1)(AO2) (1)(AO2)	**2**
(h)	Both reactions occur <u>Not</u> reversible At same rate or concentration constant	(1)(AO1) (1)(AO1)	**2**
(i)	<u>Equilibrium</u> shifts To oppose constraint owtte	(1)(AO1) (1)(AO1)	**2**
(j)	Less moles of gas on RHS Forward reaction favoured / favours less moles Equilibrium shifts to RHS / or reduces pressure	(1)(AO2) (1)(AO2) (1)(AO2)	**3**
(k)	Higher energy costs Higher capital costs	(1)(AO2) (1)(AO2)	**2**
(l)	Decreases Favours reverse reaction Endothermic / reduces Temperature	(1)(AO2) (1)(AO2) (1)(AO2)	**3**

Total Mark: 25

Question 4

(a)	Collect gas In graduated container e.g. gas syringe Time Change in mass balance as alternative to first 2 marks Max 2	(1)(AO3) (1)(AO3)	**2**
(b)	Find gradient Using tangent to curve	(1)(AO2) (1)(AO2)	**2**
(c)	Other concentrations Temperature Pressure Max 2	(1)(AO3) (1)(AO3)	**2**
(d)(i)	Second Rate quadruples as concentration doubles	(1)(AO2) (1)(AO2)	**2**
(ii)	First Rate doubles as concentration doubles	(1)(AO2) (1)(AO2)	**2**
(e)(i)	Rate constant	(1)(AO1)	**1**
(ii)	Temperature	(1)(AO1)	**1**

Total Mark: 12

Question 5

(a)	−1 0	(1)(AO2) (1)(AO2)	**2**
(b)(i)	Corrosive / burns	(1)(AO1)	**1**
(ii)	Toxic / poisonous / poison	(1)(AO1)	**1**
(c)	E.g. wear gloves / safety glasses	(1)(AO3)	**1**
(d)(i)	Direct	(1)(AO1)	**1**
(ii)	Capital	(1)(AO1)	**1**
(iii)	Direct	(1)(AO1)	**1**
(iv)	Indirect	(1)(AO1)	**1**
(e)	More / fresh reactants are added as products are removed	(1)(AO1) (1)(AO1)	**2**
(f)	Lower labour costs Faster production or implied faster	(1)(AO2) (1)(AO2)	**2**

Total Mark: 13