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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Applied Science 8771/8773/8776/8779

SC11 Controlling Chemical Processes

Mark Scheme

2007 examination - January series

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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)	All reactants added at start Once reaction is over, 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 more effective/successful collisions / more 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 $Q = mc\triangle t$ 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 Not doesn't take part	(1)(AO1) (1)(AO1)	**2**
(b)	Vertical axis number of 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 Not 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 Not reversible At same rate or concentration constant	(1)(AO1) (1)(AO1)	**2**
(i)	Equilibrium 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