



General Certificate of Education

Applied Science

8771/8773/8776/8779

SC11 Controlling Chemical Processes

Mark Scheme

2008 examination – January series

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(g)	Particles must possess for a collision to be successful <u>Minimum energy</u>	(1) (AO1) (1) (AO1)	2
(h)	Increase in temp gives <u>particles</u> more energy <u>More successful collisions</u> More particles / proportion of particles with energy greater than or equal to E_a	(1) (AO2) (1) (AO2) (1) (AO2)	3

Total Mark: 22**Question 3**

(a)	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$ $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	(1) (AO2) (1) (AO2)	2
(b)(i)	flammable	(1) (AO1)	1
(ii)	chlorine	(1) (AO1)	1
(iii)	Some method of preventing breathing fumes – allow fume cupboard despite the fact this is an industrial process	(1) (AO1)	1
(c)(i)	58.5 40	(1) (AO2) (1) (AO2)	2
(ii)	$585 / 58.5$ $117\text{kg} \rightarrow 80\text{kg} / 58.5\text{kg} \rightarrow 40\text{kg}$ $\times 40 = 400\text{ kg}$ ignore units unless wrong allow ECF from (i)	(1) (AO2) (1) (AO2)	2
(d)(i)	$50000/2 = 25000$ mark is for dividing by 2	(1) (AO2)	1
(ii)	$25000 \times 22.4\text{dm}^3 = 560,000$ ecf from (d)(i) (ignore units)	(1) (AO2)	1
(e)(i)	Indirect	(1) (AO1)	1
(ii)	Direct	(1) (AO1)	1
(iii)	Capital	(1) (AO1)	1
(iv)	Direct	(1) (AO1)	1
(f)(i)	+1	(1) (AO2)	1
(ii)	-1	(1) (AO2)	1
(g)	$100/80$ $\times 160 = 200$ (ignore units)	(1) (AO2) (1) (AO2)	2

Total Mark:19

Question 4

(a)	Any three from Balance allow scales Measuring cylinder/ bulb pipette/ burette Calorimeter/ copper can Thermometer stirrer	(3) (AO3)	3
(b)	Mass of butane <u>and</u> temperature If state before and after for either then gain second mark Third mark for stating must measure mass of water, and must say before and after for both temperature of water and mass of butane	(1) (AO3) (1) (AO3) (1) (AO3)	3
(c)	Any 2 from Lid on calorimeter Reduce draughts Stir water consistently Insulate calorimeter Repeat experiment	 (1) (AO3) (1) (AO3)	2
(d)	$Q = mc\Delta T$ 2 nd mark only awarded if realise that $m =$ mass of water	(1) (AO1) (1) (AO1)	2

Total Mark: 10

Question 5

(a)	Incomplete reaction / side reactions / very slow rate	(1) (AO2)	1
(b)	Any 2 of <u>Forward</u> and <u>reverse</u> reactions (Continuously) occur at same rate Concentrations of reactants and products are constant	(1) (AO1) (1) (AO1)	2
(c)(i)	Heat given out/exothermic	(1) (AO1)	1
(ii)	Equilibrium shifts to Oppose the imposed change/constraint	(1) (AO1) (1) (AO1)	2
(iii)	Decrease More moles of gas on left (or converse) Equilibrium shifts to <u>increase pressure</u>	(1) (AO2) (1) (AO2) (1) (AO1)	3
(iv)	$K_c = \frac{[\text{NH}_3]^2}{[\text{H}_2]^3[\text{N}_2]}$ Correct fraction Correct indices	(1) (AO2) (1) (AO2)	2
(v)	$\text{mol}^{-2} \text{dm}^6$ consequence on (iv)	(1) (AO2)	1

Total Mark: 12