



General Certificate of Education

Applied Science

8771/8773/8776/8777/8779

SC05 Choosing and Using Materials

Mark Scheme

2010 examination – January series

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Question 1

(a)(i)	Malleable / can be hammered (or pressed) into shape (not can be shaped)	(1)(AO1)	1
(ii)	Brittle	(1)(AO1)	1
(b)	In any order: <ul style="list-style-type: none"> Less dense / lighter Do not corrode / rust (NOT erode) 	(1)(AO1) (1)(AO1)	2
(c)(i)	Made of more than one material	(1)(AO1)	1
(ii)	Any 2 from: <ul style="list-style-type: none"> <u>stronger</u> <u>tougher</u> <u>harder</u> / more durable <p>Ignore lighter and flexible Must be a comparison</p>	(1)(AO1) (1)(AO1) (1)(AO1) Max 2	2
(d)	Glass does not scratch as easily	(1)(AO2)	1

Total Mark: 8**Question 2**

(a)	Any 2 from: <ul style="list-style-type: none"> same thickness of each pane of glass same area of panes same time 	(1)(AO3) (1)(AO3) (1)(AO3) Max 2	2
(b)(i)	Suitable scale on both axes All points plotted correctly (Half a small square latitude) Line of best fit drawn	(1)(AO2) (1)(AO2) (1)(AO2)	3
(ii)	As air gap increases the rate of heat loss decreases (or converse)	(1)(AO2)	1
(iii)	3000W (unit needed for the mark) allow reading from graph	(1)(AO2)	1
(c)	Advantage: better thermal insulation / doesn't need painting / less liable to rot / longer lasting / does not warp(or swell) Disadvantage: difficult to repair / colour may fade / made from a non-renewable resource / aesthetically unpleasing	(1)(AO2) (1)(AO2)	2
(d)	Guttering / drainpipes / toys / electrical insulation / water proofing / floor tiles / doors / imitation leather	(1)(AO1)	1

Total Mark: 10

Question 3

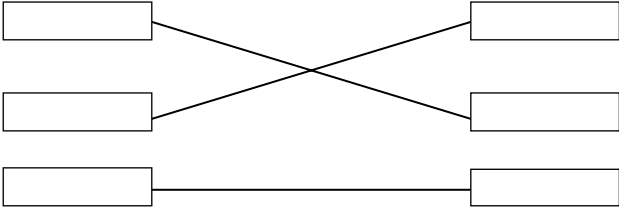
(a)	Polymer: made up of long chain molecules / a long chain molecule (NOT a long chain of molecules) / a long chain of monomers. Density: mass divided by volume/mass per unit volume/g per cm ³ /kg per m ³ . Tensile strength: force required to <u>break</u> (or <u>snap</u>) / how difficult it is to <u>break</u> (or <u>snap</u>)	(1)(AO1) (1)(AO1) (1)(AO1)	3
(b)	Has a <u>higher</u> (tensile) strength. (NOT just high tensile strength) / stronger (NOT just strong)	(1)(AO1)	1
(c)	Wrapping / bags (not cups)	(1)(AO1)	1
(d)(i)	Poly(propene)	(1)(AO1)	1
(ii)	In any order: <ul style="list-style-type: none"> Not soluble in organic solvents Has <u>highest</u> maximum operating temperature / maximum operating temperature is above 120°C 	(1)(AO1) (1)(AO1)	2
(e)(i)	Structure C	(1)(AO1)	1
(ii)	Structure A	(1)(AO1)	1
(iii)	(Cross links) prevent movement of molecules / chains.	(1)(AO1)	1

Total Mark: 11**Question 4**

(a)(i)	Ionic	(1)(AO1)	1
(ii)	Electrons are transferred From metal (or Mg) to non-metal (or O)	(1)(AO1) (1)(AO1)	2
(b)(i)	Covalent	(1)(AO1)	1
(ii)	Electrons are shared	(1)(AO1)	1
(c)(i)	Double bond / C=C	(1)(AO1)	1
(ii)	Monomer	(1)(AO1)	1
(iii)	Polythene	(1)(AO1)	1

Total Mark: 8**Question 5**

(a)	Rate of flow of heat per unit area per unit temperature gradient OR heat conducted per second divided by (cross sectional area x temperature gradient)	(1)(AO1)	1
(b)	In any order: <ul style="list-style-type: none"> Length Cross- sectional area 	(1)(AO1) (1)(AO1)	2
(c)	Material A In any order: <ul style="list-style-type: none"> <u>High</u> electrical conductivity / best conductor of electricity <u>High</u> thermal conductivity / best conductor of heat <u>High</u> density (Reason marks are independent of the material chosen)	(1)(AO1) (1)(AO1) (1)(AO1)	4

(d)(i)	Material B	(1)(AO1)	1
(ii)	Ceramic	(1)(AO1)	1
(e)(i)	Expansion divided by (original length x temperature rise)	(1)(AO1)	1
(ii)	Need to allow for expansion / contraction	(1)(AO1)	1
(f)	 <p>All three correct = 2 marks One correct = 1 mark</p>	(1)(AO1) (1)(AO1)	2
(g)(i)	Mixture of elements containing at least one metal / mixture of metals	(1)(AO1)	1
(ii)	Alloy is stronger / has improved properties (NOT better conductor)	(1)(AO1)	1
(h)	$M = D \times V$ $= 2.7 \times 10^3 \times 5 \times 10^{-4}$ $= 1.35 \text{ kg}$ 2 marks for correct answer 1 compensation mark for correct formula or substitution 1 mark for unit	(1)(AO2) (1)(AO2) (1)(AO1)	3

Total Mark: 18**Question 6**

(a)	Any 7 of the following: <ul style="list-style-type: none"> • Hold string so that bottom of hanger is a measured / stated distance above the wooden block • Let go of string / let hanger drop • Examine sample to see if it has been dented • If not drop same mass from a greater height • Record height needed to produce a visible dent • Using the metre rule • If there is no dent when the height can no longer be increased • Increase the mass on the holder • Measure the diameter of the dent • Using the vernier callipers • Repeat with the other two samples 	(1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) Max 7	7
(b)	The smaller the diameter of the dent / the greater the height from which the masses are dropped to cause a dent, the harder the material	(1)(AO3)	1

Total Mark: 8

Question 7

(a)	Man made / not natural	(1)(AO1)	1
(b)	$C_6H_{16}N_2$ (accept symbols in any order but numbers must be subscript)	(1)(AO2)	1
(c)	They both contain 6 carbon atoms	(1)(AO2)	1
(d)(i)	Molecules drawn parallel to each other	(1)(AO1)	1
(ii)	Makes it stronger / increases tensile strength	(1)(AO1)	1
(e)(i)	Any 2 from: <ul style="list-style-type: none"> Lightweight Saves energy Aids or enhances athletes performance (OWTTE) 	(1)(AO1) (1)(AO1) (1)(AO1) Max 2	2
(ii)	Any 2 from: <ul style="list-style-type: none"> Hardwearing / tough / durable Flexible Weather proof / water proof / resistant to chemicals 	(1)(AO1) (1)(AO1) (1)(AO1) Max 2	2
(f)	They absorb <u>perspiration</u>	(1)(AO2)	1
(g)(i)	Stress = force divided by cross-sectional area	(1)(AO1)	1
(ii)	Strain = extension divided by original length	(1)(AO1)	1
(h)(i)	It is a ratio of two lengths / idea that units cancel out	(1)(AO1)	1
(ii)	Young modulus = stress / strain 2 marks for correct answer = $9 \times 10^{-3} / 6 \times 10^{-2}$ = $1.5 \times 10^{-1} \text{ Nm}^{-2} (\text{Pa})$ (1 compensation mark for correct formula or substitution) 1 mark for unit	(1)(AO2) (1)(AO2) (1)(AO1)	3
(iii)	Stiffness is low / very flexible / easy to bend	(1)(AO1)	1

Total Mark: 17