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ASSESSMENT and QUALIFICATIONS ALLIANCE

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: • 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: • stronger • tougher • harder / more durable Ignore lighter and flexible Must be a comparison	 (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: • 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 break(or snap) / how difficult it is to break (or snap)	(1)(AO1) (1)(AO1) (1)(AO1)	**3**
(b)	Has a higher (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: • Not soluble in organic solvents • Has highest 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

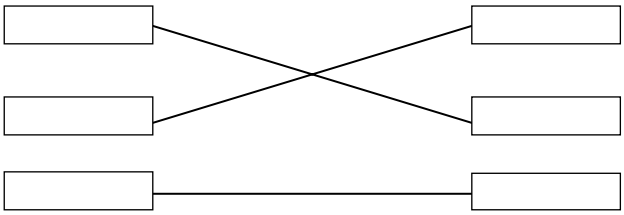
Question 4

(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: • Length • Cross- sectional area	(1)(AO1) (1)(AO1)	**2**
(c)	Material A In any order: • High electrical conductivity / best conductor of electricity • High thermal conductivity / best conductor of heat • High density (Reason marks are independent of the material chosen)	(1)(AO1) (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 alloy for expansion / contraction	(1)(AO1)	**1**
(f)	 All three correct = 2 marks One correct = 1 mark	 (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 x V = $2.7 \times 10^3 \times 5 \times 10^{-4}$ = 1.35 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: • 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) (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: • Lightweight • Saves energy • Aids or enhances athletes performance (OWTTE)	 (1)(AO1) (1)(AO1) (1)(AO1) **Max 2**	**2**
(ii)	Any 2 from: • Hardwearing / tough / durable • Flexible • Weather proof / water proof / resistant to chemicals	 (1)(AO1) (1)(AO1) (1)(AO1) **Max 2**	**2**
(f)	They absorb perspiration	(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 $= 9 \times 10^{-3} / 6 \times 10^{-2}$ $= 1.5 \times 10^{-1}$ Nm^{-2} (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