



General Certificate of Education

Applied Science **8771/8773/8776/8779**

SC05 Choosing and Using Materials

Mark Scheme

2008 examination – January series

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Question 1

(a)	Improved chemical resistance, e.g. prevent corrosion Accept to prevent altering taste of contents	1 mark	1
(b)	Any two of the following, one mark each environmental factors, e.g. recycling cost availability ease of printing labels/ colouring can	2 marks	2

Total Mark: 3**Question 2**

(a)(i)	As the force increases, so does the extension there is a linear relationship/ directly proportional "Directly proportional" = 2 marks Do NOT allow "It is elastic"	1 mark 1 mark	2
(ii)	non linear/ extension increases at a much greater rate gradient increases as force increases Do NOT allow "It is plastic"	1 mark	1
(b)(i)	Any point on the linear section labelled	1 mark	1
(ii)	Any point on the curved section labelled	1 mark	1
(c)	Any line drawn back to intersect the y-axis <i>with a permanent extension</i> (or which would do so if extrapolated)	1 mark	1
(d)(i)	Stress = force/area (or described) Accept load/area	1 mark	1
(ii)	Strain = extension/original length (or described)	1 mark	1
(iii)	Because it is a ratio / idea that units cancel out	1 mark	1
(iv)	Suitable scale, correctly labelled, on x axis Suitable scale, correctly labelled, on y axis N.B. Allow axes either way round Scale should be such that data occupies at least 1/3 rd of scale Points plotted correctly (allow 1 plotting error) Suitable straight line drawn in	1 mark 1 mark 1 mark 1 mark	4
(v)	2×10^{11} (accept equation or correct numerical expression unless negated by incorrect calculation) Nm^{-2} (accept Pa)	1 mark 1 mark	2
(vi)	10^6 (or correct numerical expression or relationship) (accept equation or correct numerical expression unless negated by incorrect calculation) Nm^{-2} (accept Pa)	1 mark 1 mark	2
(vii)	Flexibility/ stiffness/density/ mass	1 mark	1

Total Mark: 18

Question 3

(a)	Crystalline	1 mark	1
(b)	Metallic	1 mark	1
(c)(i)	An atom is missing	1 mark	1
(ii)	Idea of dislocation moving through the crystal leading to plastic deformation	1 mark 1 mark	2
(d)(i)	Able to be hammered out / flattened into a sheet	1 mark	1
(ii)	Annealing/ work hardening/ tempering/quenching/cold drawing/extruding/alloying	1 mark	1

Total Mark: 7**Question 4**

(a)	Any two from the following, one mark each greater strength/ harder to bend/greater stiffness/higher Young Modulus Lighter weight/lower density/takes less energy to ride Cheaper Do NOT accept "easier to ride"	2 marks	2
(b)(i)	A mixture, at least one component of which is a metal	1 mark	1
(ii)	For each part, read the 'advantage' and the 'explanation' together, and award up to 2 marks 1 mark is for the identification of the physical property, the other mark is for explaining why this is an advantage <i>Aluminium alloy:</i> any two from the following, one mark each Low density Therefore bicycle will weigh less/ takes less energy to use OR Low Young Modulus So frame quite flexible <i>Steel alloy:</i> any two from the following, one mark each But high strength So frame should not break OR High Young Modulus So frame quite stiff <i>Titanium alloy:</i> any two from the following, one mark each Idea of intermediate value for Young Modulus/strength/density Idea of compromise between aluminium and steel, or described e.g. frame quite flexible but strong enough not to break	2 marks 2 marks 2 marks	6
(iii)	Cost/ availability/corrosion resistance/ease of fabrication/ ease of colouring/ recycling potential	1 mark	1

(iv)	Measure mass of tube Method of measuring mass, e.g. weight it/ use top pan balance Measure volume of tube Method of measuring volume, e.g. immersion in water Calculate density by dividing mass by volume	1 mark 1 mark 1 mark 1 mark 1 mark	5
(c)(i)	Top right graph ticked	1 mark	1
(ii)	(High) flexibility/ stretches easily/ easy to mould/ (high) elasticity	1 mark	1
(iii)	Equation (expansion/original length x temperature rise) or described otherwise	1 mark	1
(iv)	otherwise tyre may come off rim	1 mark	1
(v)	equation or description, e.g. rate of flow of heat per unit area per unit temperature gradient	1 mark	1
(vi)	otherwise tyre may burn/ melt/ be damaged	1 mark	1

Total Mark: 21**Question 5**

(a)	material made from a combination of different types	1 mark	1
(b)	plastic may protect surface (crossed grain should give) added strength	1 mark 1 mark	2
(c)	grain is lengthways	1 mark	1
(d)(i)	C labelled on top surface of shelf	1 mark	1
(ii)	T labelled on bottom surface of	1 mark	1

Total Mark: 6**Question 6**

	Any six of the following, one mark each tie bag over end of tube drop bolt down tube if bag does not break: increase drop height and repeat OR increase bolt mass and repeat OR keep repeating drop until bag does break continue increase or repeats until bag breaks measurement of height of drop or mass of bolt taken measuring instruments specified, e.g. ruler/ balance idea of fair test, e.g. same bolt mass or same height idea of repeats to improve reliability conclusion, e.g. strongest bag corresponds to greatest height or mass	6 marks	6
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Total Mark: 6

Question 7

(a)	Wire type D Reason 1 - correct data identified from table explanation of this Reason 2 - correct data identified from table explanation of this	1 mark 1 mark 1 mark 1 mark 1 mark	5
	These are independent marks and do not depend upon the correct choice of wire initially Suitable reasons and explanations are: Melting point high So that wire does not melt Electrical conductivity very high therefore current/ heating effect very high Thermal conductivity low therefore less heat conducted away Thermal expansivity low therefore wire will not expand/ fall off/ unwind Ultimate tensile strength high therefore wire unlikely to snap or break		
(b)	S or $\Omega^{-1}\text{m}^{-1}$ or equivalent		1

Total Mark: 6**Question 8**

(a)(i)	<u>(Tensile) force/ strength needed to break it</u> Weight	1 mark	1
(ii)	So that any artefact made from it will have a small weight	1 mark	1
(iii)	Resistant to water/ resistant to acids/ heat resistant	1 mark	1
(b)(i)	Covalent Double bond	1 mark 1 mark	2
(ii)	A hydrogen atom from (the NH_2 group on) one monomer Joins with a chlorine atom from the other monomer To form HCl	1 mark 1 mark 1 mark	3
(iii)	Weak	1 mark	1
(c)	Line showing a positive gradient	1 mark	1
(d)	Any two of the following points Bullet or stab wound applies force very quickly/ shear rate very high Turning to solid Effectively increases the area Force is spread over a greater area Pressure is force/area Therefore pressure is reduced	2 marks	2
(e)	Lighter/ more flexible	1 mark	1

Total Mark: 13