



**General Certificate of Education (A-level) Applied
January 2011**

Applied Science

SC05

**(Specification
8771/8773/8776/8777/8779)**

Unit 5: Choosing and Using Materials

Post-Standardisation

Mark Scheme

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Question	Part	Sub-part	Marking guidance		Mark	Comment
1				1(AO1) 1(AO1) 1(AO1) 1(AO1) 1(AO1) 1(AO1)	6	
2			In order B A C	1(AO1) 1(AO1) 1(AO1)	3	
3	(a)	(i)	Smooth / elastic / tight fitting / not baggy / streamlined / aerodynamic	1(AO2)	1	
3	(a)	(ii)	Desirable: elastic or tough Reason: will return to original shape (when load removed) Or will withstand shock or impact (without breaking) Undesirable: plastic or brittle	1(AO1) 1(AO1) 1(AO1) 1(AO1)	4	

			Reason: will remain deformed (when load removed) Or will shatter / snap / fracture / crack			
3	(b)	(i)	Made of more than one material	1(AO1)	1	
3	(b)	(ii)	To gain the properties of each material (not just stronger) / better (or improved) properties / desired properties	1(AO1)	1	
3	(b)	(iii)	Tick: elastic flexible strong	1(AO2) 1(AO2) 1(AO2)	3	
3	(b)	(iv)	No plastic deformation (or almost none) / only deforms elastically / shatters / snaps / fractures / cracks	1(AO1)	1	
3	(c)	(i)	Laminate	1(AO1)	1	
3	(c)	(ii)	Fibre	1(AO1)	1	
4	(a)	(i)	Measure with a ruler / metre rule	1(AO3)	1	
4	(a)	(ii)	Repeat measurements	1(AO3)	1	
4	(b)	(i)	All 5 points plotted correctly	1(AO2)	1	
4	(b)	(ii)	Straight line through all points	1(AO2)	1	
4	(c)	(i)	196mm / value from graph	1(AO1)	1	
4	(c)	(ii)	130mm / value from graph	1(AO1)	1	
4	(d)	(i)	Hooke's law	1(AO1)	1	
4	(d)	(ii)	Extension directly proportional to load / owtte	1(AO1)	1	

4	(e)	(i)	175g / value from graph	1(AO1)	1	
4	(e)	(ii)	Density = $m \div v = 175 \div 70 = 2.5 \text{ gcm}^{-3}$ 2 marks for correct answer (allow ecf from (e)(i)) 1 compensation mark for correct formula or substitution 1 mark for correct units	1(AO2) 1(AO2) 1(AO1)	3	
4	(f)		Any 6 of the following: Find mass of empty flask Using balance Pour liquid into flask Find mass of liquid and flask Subtract masses to give mass of liquid Measure volume of liquid Using measuring cylinder Find density using density = mass \div volume (do not give last point if already given in (e)(ii))	1(AO3) 1(AO3) 1(AO3) 1(AO3) 1(AO3) 1(AO3) Max 6	6	
5	(a)		Alloy	1(AO1)	1	
5	(b)		Amalgam	1(AO1)	1	
5	(c)		Gold is unreactive / chemically resistant	1(AO1)	1	
5	(d)		Gold is soft / good conductor of heat (Ignore expensive)	1(AO1)	1	
5	(e)		To measure force needed to chew food / to measure pressure fillings could stand without cracking / to measure quantities needed to make fillings	1(AO1)	1	
5	(f)		If had to be poured into cavities at 100°C / at a high temperature	1(AO1)	1	
5	(g)		Tin	1(AO1)	1	

5	(h)		To withstand forces (or does not break) as teeth crush / grind / chew food	1(AO1)	1	
5	(i)		Composite poor conductor of heat but amalgam good conductor Composite less likely to be heat sensitive / less likely to be painful / less likely that heat reaches the nerve (or converse)	1(AO1) 1(AO2)	2	
5	(j)		Filling may expand too much and crack tooth / filling may not expand enough and come loose	1(AO1)	1	
5	(k)		Pigments can make the filling have the same colour as teeth	1(AO1)	1	
6	(a)	(i)	Arrow at force of 82 – 84N	1(AO1)	1	
6	(a)	(ii)	Extension is permanent / wire is permanently stretched (or deformed) / extension does not return to zero / wire will not return to original <u>length</u>	1(AO1)	1	
6	(b)	(i)	Strain = extension ÷ original length = $3.4 \times 10^{-3} \div 4$ = 8.5×10^{-4} 2 marks for correct answer 1 compensation mark for correct formula / substitution	1(AO2) 1(AO2)	2	
6	(b)	(ii)	Stress = force ÷ area = $60 \div 6.3 \times 10^{-7}$ = $9.5 \times 10^7 \text{ Nm}^{-2}$ (Pa) 2 marks for correct answer 1 compensation mark for correct formula / substitution 1 mark for correct unit	1(AO2) 1(AO2) 1(AO1)	3	

6	(b)	(iii)	Young modulus = stress \div strain = $9.5 \times 10^7 \div 8.5 \times 10^{-4}$ = $1.12 \times 10^{11} \text{ Nm}^{-2} \text{ (Pa)}$ (accept 1.11×10^{11}) 2 marks for correct answer (allow ecf from (b)(i) and / or (b)(ii)) 1 compensation mark for correct formula / substitution 1 mark for correct unit	1(AO2) 1(AO2) 1(AO1)	3	
6	(c)		Tick next to 'original length'	1(AO2)	1	
6	(d)		Ratio of two lengths / idea that units cancel out	1(AO1)	1	
6	(e)	(i)	There is plastic deformation	1(AO1)	1	
6	(e)	(ii)	Alloying / annealing / quenching / cold drawing	1(AO1)	1	
6	(f)		Electrons are delocalised / free in structure / sea of electrons These electrons can move in an organised way	1 (AO1) 1(AO1)	2	
7	(a)		Aluminium	1(AO2)	1	
7	(b)		$0.57 = 100 \times 0.000019 \times \text{temperature change}$ temperature change = $0.57 \div 0.0019 = 300$ $\therefore \text{temperature} = 320^\circ\text{C}$ 2 marks for correct answer 1 compensation mark for correct substitution / rearrangement / 300 1 mark for correct units	1(AO2) 1(AO2) 1(AO1)	3	
7	(c)	(i)	Coefficient of expansion for pyrex is much lower than that of normal glass (or converse)	1(AO2)	1	
7	(c)	(ii)	The inside of the pyrex dish does not expand as much	1(AO2)	1	

7	(d)	(i)	Random or irregular arrangement of particles	1(AO1)	1	
7	(d)	(ii)	Any correct answer e.g. porcelain (or china) / pottery / brick / tile	1(AO1)	1	
7	(e)	(i)	Equation or description i.e. heat conducted per second ÷ (cross-sectional area x temperature gradient) or rate of flow of heat per unit area per unit temperature gradient	1(AO1)	1	
7	(e)	(ii)	The wax will melt and the pins drop off The pin will drop off first for the best conductor The pin will drop off last for the worst conductor	1(AO1) 1(AO1) 1(AO1)	3	