A-LEVEL
Applied Science
SC05 Choosing and Using Materials
Mark scheme

8770
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Version 1: Final Mark Scheme

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Question	Answers	Additional Comments/Guidance	Mark	ID details
1(a)(i)	In order: composite ceramic		2	
1(a)(ii)	Material A : metal high melting point Material B : polymer low density	**Not** 'thermal conductor'	2 2	
1(b)(i)	(u)PVC / Aluminium	Accept plastic / polymer	1	
1(b)(ii)	Any two from: does not rot / doesn't need painting / low maintenance / lasts longer / low density (lightweight) / more durable / does not warp / chemically resistant	**Not** does not rust / corrode **Not** waterproof	2	
1(c)	Synthetic		1	
Total			**10**	

2(a)	• *Elastic limit*: up to this point stress is proportional to strain / force is proportional to extension / undergoes only elastic deformation / will return to original length when force is removed / obeys Hooke's law • *Ultimate tensile strength*: greatest stress / force before fracturing	Accept converse of these statements if the answer refers to 'beyond the elastic limit'.	1 1	
2(b)(i)	A and B		1	
2(b)(ii)	C and E		1	
2(c)	• *Brittle*: the graph shows no plastic deformation / only elastic deformation • *Ductile*: the graph shows (elastic and) plastic deformation / permanent deformation		1 1	
2(d)(i)	15 (cm)		1	
2(d)(ii)	10 (cm)		1	
2(d)(iii)	30 (g) Allow ecf from (d)(ii)		1	
2(d)(iv)	Tensile force / tension		1	
Total			**10**	

3(a)(i)	• Wood to aluminium, flexibility increases • Aluminium to graphite, flexibility decreases		1 1	
3(a)(ii)	Easier to hit the ball	Accept greater chance of hitting the ball	1	
3(a)(iii)	Made of more than one material (bonded together)	**Not** chemically bonded	1	
3(a)(iv)	Any 3 from: • lighter • more powerful / harder hitting • more durable / longer lasting • easier to hit the ball / greater chance • does not warp / deform	Accept: better control more spin Accept 'can hit the ball harder and still retain accuracy'	3	
3(b)(i)	• Stretching a fibre (at room temperature) / make fibre thinner • Until it will no longer stretch		1 1	
3(b)(ii)	Chains become aligned / parallel to each other		1	
3(b)(iii)	Stronger / more tension		1	
Total			**11**	

4(a)		I	C	B
		✓		
			✓	
			✓	
				✓
			✓	
	All 5 correct = 3 marks 4 correct = 2 marks 3 correct = 1 mark 2/1 correct = 0 marks		3	

4(b)		I	D	S
		✓		
				✓
				✓
		✓		
	All 4 correct = 2 marks 3 correct = 1 mark 2/1 correct = 0 marks		2	

4(c)(i)	In any order: • electron • <u>metal</u> ion / <u>positive</u> ion		1 1	
4(c)(ii)	• Electrons are delocalised / free in structure / sea of electrons • These electrons can move as a current / can move when a potential difference is applied / can transfer energy / can move and carry charge through metal		1 1	
4(d)	• *Amorphous*: random arrangement of particles (atoms) / irregular / no pattern • *Crystalline*: regular arrangement of particles (atoms) / repeating pattern		1 1	
Total			**11**	

5(a)	Can be hammered / beaten / pressed / moulded into shape	**Not** just 'can be shaped'	1	
5(b)	Alloy		1	
5(c)	• In pure copper the layers / atoms / ions can slide past each other • In bronze the tin atoms (ions) / have different sized atoms (ions) / irregular structure • Stop the layers / atoms / ions from sliding past each other (as easily)	The second marking point can be obtained from a diagram	1 1 1	
5(d)	Any 2 from: annealing / quenching / tempering / cold drawing / work hardening		2	
5(e)(i)	51.6 (g)		1	
5(e)(ii)	Volume = mass ÷ density = 0.06 ÷ 8650 = 6.9×10^{-6} m^3	• 2 marks for correct answer • 1 compensation mark for correct formula/ substitution • 1 mark for correct unit	3	
5(f)(i)	• Axes in correct places with suitable scales and labels (name & unit) • All 5 points plotted correctly (± half a small square) • Line of best fit (straight line)		1 1 1	
5(f)(ii)	8.9×10^3 / 8900 / value from candidate's graph.		1	
5(g)	• concentration of salt in water • temperature • duration of test • size / surface area of the sample	All three correct = 2 marks Two correct = 1 mark	2	
Total			**17**	

6	1 mark for each point. • Labelled diagram of sample, method of suspension, load and ruler. • Measure sample position against ruler. • Add load. • Measure new sample position to obtain deflection / amount of bending. • Repeat to check answer. • Use a second sample which is the same length, width and thickness as the first sample. • Repeat the experiment with the second sample. • The sample with the lower deflection / least amount of bending is less flexible (or stiffer).	Accept converse	8	
Total			**8**	

7(a)(i)	To keep the control wire straight / taut		1	
7(a)(ii)	To stretch the test wire / to put stress on the wire / to increase tension		1	
7(a)(iii)	Cross-sectional area		1	
7(a)(iv)	Extension (of test wire) / change in length	**Not** expansion	1	
7(a)(v)	Strain = change in length ÷ original length	Accept 'extension' for 'change in length'	1	
7(a)(vi)	Stress = force ÷ cross-sectional area	Accept 'load' for 'force'	1	
7(a)(vii)	Y M = stress ÷ strain		1	
7(b)(i)	Strain = $3.5 \times 10^{-4} \div 1.2$ (or $0.35 \div 1200$) $= 2.9 \times 10^{-4}$ (Accept 3×10^{-4})	• 2 marks for correct answer • 1 compensation mark for correct substitution	2	
7(b)(ii)	Stress = YM × strain $= 1.9 \times 10^{11} \times 2.9 \times 10^{-4}$ $= 5.5 \times 10^{7}$ (N m^{-2}) (Accept 6×10^{7}) Force = stress × area $= 5.5 \times 10^{7} \times 1.4 \times 10^{-7}$ = 7.7 (N) (Accept 8)	• 2 marks for correct answer • 1 compensation mark for correct formula / substitution. Allow ecf from 7(b)(i) • 2 marks for correct answer • 1 compensation mark for correct formula / substitution Allow ecf from stress calculation	2 2	
Total			**13**	