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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Applied Science 8771/8773/8776/8779

SC05 Choosing and Using Materials

Mark Scheme

2009 examination – January series

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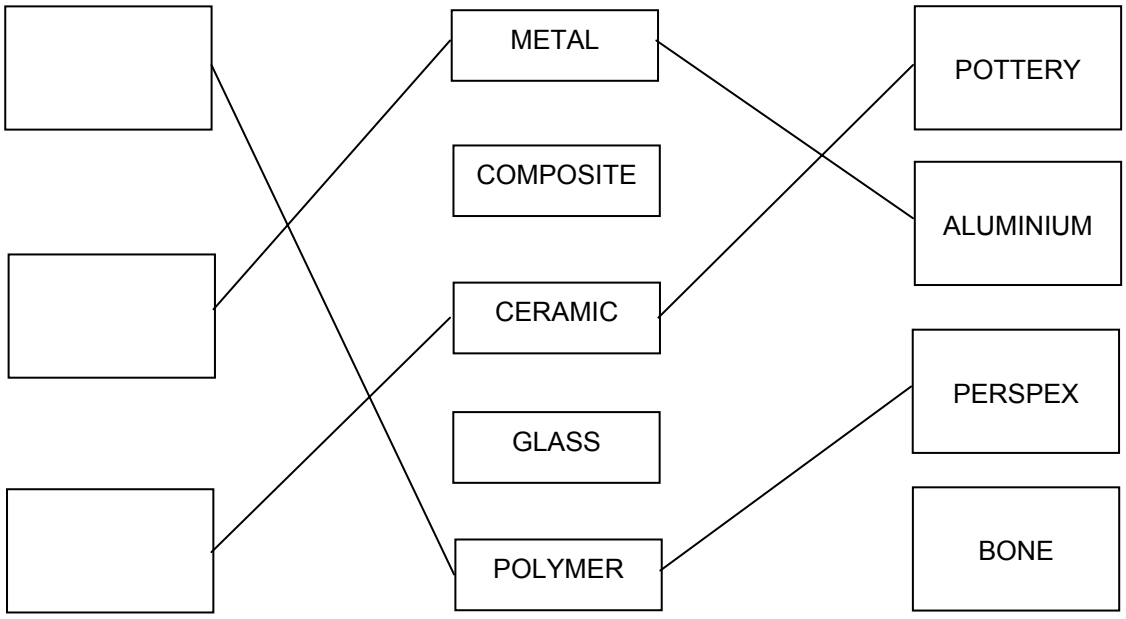
Question 1

	Each properties box correctly linked to the type of material it describes (1 mark each) Each correct type of material linked correctly to its example (1 mark each) (See diagram at end of mark scheme) Mark LHS and RHS independently Mark LHS first – if more than one line from any properties box then no mark for that box When marking the RHS mark only the type of material boxes that are linked singly to a properties box	(3) (AO1) (3) (AO1)	**6**

Total Mark: 6



Question 2

(a)	Pure metals are too soft / alloys are stronger	(1) (AO1)	**1**
(b)	High carbon Cast iron Low carbon	(1) (AO1) (1) (AO1) (1) (AO1)	**3**
(c)	Vanadium Nickel & Chromium (accept either metal on its own) Cobalt	(1) (AO1) (1) (AO1) (1) (AO1)	**3**
(d)(i)	Fuel economy / less damage to road surface / can carry heavier loads Bridge spans can be longer / fewer supporting beams	(1) (AO2) (1) (AO2)	**2**
(ii)	Easily drawn out into pipes/wires / shows both elastic and plastic behaviour	(1) (AO1)	**1**
(iii)	Resistant to corrosion / high chemical resistance	(1) (AO1)	**1**
(e)	(Stainless steel is) more expensive (not 'cost' alone)	(1) (AO1)	**1**
(f)(i)	Can withstand the forces as teeth crush together	(1) (AO2)	**1**
(ii)	Drinking something hot can be painfull / heat reaches the nerve of the tooth / reference to sensitivity	(1) (AO2)	**1**
(iii)	Hot drink may cause filling to expand too much and crack tooth / or not expand enough and come loose	(1) (AO2)	**1**

Total Mark: 15

Question 3

(a)	Diagram B (no mark) The force is across the grain / wood is strong when force is parallel to grain (or converse)	(1) (AO1)	**1**
(b)	The grains in adjacent sheets are at right angles / in different directions / in both directions	(1) (AO1)	**1**
(c)	It does not have a grain	(1) (AO1)	**1**
(d)	Two from • stronger than wood • lighter than wood / less dense • does not rot (do not accept corrode)	(1) (AO1) (1) (AO1)	**2**
(e)(i)	Axes drawn in correct place and labelled Suitable scales and units All five points plotted correctly Line of best fit drawn (not dot to dot) –the graph is a curve	(1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3)	**4**
(ii)	Tensile strength increases as % of glass increases (or converse)	(1) (AO2)	**1**
(iii)	Extrapolate curve back to tensile strength axis (i.e. % of glass = 0) and read value	(1) (AO2)	**1**
(f)(i)	Point D	(1) (AO2)	**1**
(ii)	A line drawn in the lower half of the beam	(1) (AO2)	**1**

Total Mark: 13

Question 4

(a)	To ensure the rod has expanded fully / has stopped expanding / has reached its highest temperature / has reached temperature of steam	(1) (AO1)	**1**
(b)	To allow the rod to expand / so micrometer is not damaged	(1) (AO1)	**1**
(c)(i)	82.9 °C	(1) (AO1)	**1**
(ii)	0.79 mm	(1) (AO1)	**1**
(iii)	0.79/ 502 x 82.9 OR 0.079/ 50.2 x 82.9 = 0.000019 / 1·9 × 10^{-5} (this answer without any working = 2 marks) ecf from (i) and/or (ii)	(1) (AO2) (1) (AO2)	**2**
(d)	The ruler is measuring a much larger distance than the micrometer/the larger the measurement the smaller the error	(1) (AO2)	**1**
(e)(i)	0.000012(m) / 1·2 × 10^{-5}(m)	(1) (AO2)	**1**
(ii)	0.012(m) / 1·2 × 10^{-2}(m) ecf from (i) ie 1000 × ans. to (e)(i)	(1) (AO2)	**1**
(iii)	0.24(m) ecf from (ii) or (i) ie 20 × ans. to (e)(ii)	(1) (AO2)	**1**
(iv)	The bridge moves on the rollers as it expands / contracts gap at end allows movement	(1) (AO1) (1) (AO1) (1) (AO1)	**3**
(f)	Copper on the outside of the curve / iron on inside	(1) (AO2)	**1**
(g)(i)	P = platinum Q = aluminium If the correct metals are given but the wrong way round – give 1 mark	(1) (AO2) (1) (AO2)	**2**
(ii)	Increase gap between the contacts/loosen the screw	(1) (AO2)	**1**

Total Mark: 17

Question 5

(a)(i)	Any 7 of the following points in a logical order
	• Measure the length of the material that sticks out freely
	• Tie the mass holder to the free end of the material (using string)
	• At a measured distance from the end / through the hole at the end
	• Fix needle to free end of the material using sticky tape
	• Clamp the metre rule vertically into the stand
	• Adjust position of metre rule so that the needle is in line with the zero on the scale / note the initial reading of the needle against the scale
	• Add masses to the holder
	• Until the needle has moved down by an exact distance eg 10mm
	• Use larger and smaller masses to get as close as possible to this distance
	  • Record the mass used
	  • Repeat with the other two materials
		(7) (AO3)	**7**

(ii)	Any 2 of: • Ensure that the same length sticks out freely • The mass holder is the same distance from the free end • Repeat the experiment for each material Give marks for any of these points if mentioned in (a)(i) but not stated here.	(1) (AO3) (1) (AO3)	**2**
(iii)	The material that requires the largest mass is the stiffest (or the converse)	(1) (AO3)	**1**
(b)	It is <u>very</u> stiff	(1) (AO1)	**1**
(c)	$0{\cdot}7\times 10^{11}$ (units are not needed)	(1) (AO2)	**1**
(d)(i)	(Strain is) a ratio of two lengths/idea that units cancel out	(1) (AO1)	**1**
(ii)	Modulus = $2{\cdot}5 \times 10^{11}$ (This answer without any working = 2 marks) One compensation mark for : • Correct formula for modulus (stress÷strain) OR • Correct substitution of two values from the graph E.g. $10 \times 10^{9} \div 4 \times 10^{-2}$ Correct units (Nm^{-2} or N/m^2 or Pa) - 1 mark	(1) (AO2) (1) (AO2) (1) (AO1)	**3**
(e)(i)	Material D	(1) (AO1)	**1**
(ii)	Steepest line / largest gradient / for any value of stress it has the smallest value of strain / for any value of strain it has the largest value of stress	(1) (AO1)	**1**

Total Mark: 18

Question 6

(a)	Man made / not natural	(1) (AO1)	**1**
(b)	Amorphous - irregular structure / non-crystalline Polymer - made up of long chain molecules	(1) (AO1) (1) (AO1)	**2**
(c)	Covalent	(1) (AO1)	**1**
(d)	The <u>double (</u>covalent) bond / C = C	(1) (AO1)	**1**
(e)	C_6H_7NO (accept symbols in any order but numbers must be subscript)	(1) (AO2)	**1**
(f)	The solvent may be toxic / poisonous / harmful	(1) (AO1)	**1**
(g)	Do not have a solvent / no gaps in the join	(1) (AO1)	**1**
(h)	Solvent cannot evaporate	(1) (AO1)	**1**
(i)	Water (vapour) has entered the tube (not 'air' alone)	(1) (AO1)	**1**
(j)	Solvent evaporates more quickly / (polymerisation) reaction occurs more quickly	(1) (AO1)	**1**

Total Mark: 11