Design & Technology

Performance characteristics of materials

Materials required for questions

- Pencil
- Rubber
- Calculator

Instructions

- Use black ink or ball-point pen
- Try answer all questions
- Use the space provided to answer questions
- Calculators can be used if necessary
- Use a cross in the box to mark you answer 

Advice

- Marks for each question are in brackets
- Read each question fully
- Try to answer every question
- Don’t spend too much time on one question

Good luck!

Q1. What word describes a material that can be drawn out into long thin wires?

A Malleable ☐

B Ductile ☐

C Brittle ☐

Q2. What is a unique property of shape memory alloy (SMA)?

A Resistant to spectacle damage ☐

B Flexible ☐

C Lightweight ☐

Q3. What property describes the ability of a material to withstand sudden and shock loading without fracturing.

A Toughness ☐

B Hardness ☐

C Malleability ☐

Q4. A material that resists abrasive wear and indentation has which one of the following properties?

A Elasticity ☐

B Plasticity ☐

C Hardness ☐

Q5. Shear strength is defined as:

A The ability of a material to return to its original shape once a deforming force is removed ☐

B The ability of a material or joint to withstand being pulled apart ☐

C The ability of a material to withstand being squashed ☐

Q6. Which one of the following is not a property of mild steel?

A Malleable ☐

B Tough ☐

C Plasticity ☐

Q7. A tough material is commonly described as:

A A material that can withstand repeated impacts ☐

B A material that is hard to scratch ☐

C A material that takes a long time to decompose ☐

Q8. Which of the statements below is the definition of the physical property 'Elasticity'?

A	The ability of a material to stand up to forces being applied without it bending, breaking, shattering or deforming	☐
B	The ability of a material to absorb force and flex in different directions, returning to its original position	☐
C	The ability of a material to stretch without breaking or snapping	☐

Q9. Describe two characteristics of metal foams, that make them more suitable than solid sections, in the manufacture of some products/components **(2 marks)**

Property 1:

Property 2:

Q10. List two advantages and two disadvantages of materials that are biodegradable? **(4 marks)**

Q11. The drawing below shows a pencil sharpener

(a) Give **two** properties of carbon steel that make it suitable for the blade of a pencil sharpener **(2 marks)**

(b) Describe **one** reason why carbon steel is a better choice of metal for the blade rather than aluminium **(2 marks)**

ANSWERS NEED SORTING OUT

Answers

Q1. B
Q2. A
Q3. A
Q4. C
Q5. B
Q6. C
Q7. A
Q8. B

Q9.

Answers could include:

- Lightweight in comparison to solid form
- Low conductivity,
- Compressive strength
- Absorption of a force

Q10.

Handle:

- Steel tube has malleable characteristics that allow it to be curved into handle shape
- High strength to help resist forces from all directions (push/pull)

Side:

- Aluminium tube is lightweight reducing weight of trolley
- High strength to hold handle firmly at chosen length

Strengthening piece:

- Solid steel section to support structure of trolley
- Very tough to absorb impact of force without fracture

Shelf:

- High strength capable of holding heavy weights without flexing/breaking
- Lightweight due to its pressed shape

Q11

Advantages:

- Reduction on Carbon cycle/emissions
- Eco friendly, won't damage environment
- Renewable materials help with sustainability

Disadvantages:

- More expensive to produce this type of material
- Need for composters, biodegradable materials require specific conditions to decompose

Q12a.

Any **two** properties given from:

- Hard
- Ductile
- Malleable
- Toughness

b. **One** reason described from:

- Carbon steel is harder, which means its wears better/lasts longer
- Carbon steel can have an edge ground on it, which means it will be able to cut/shave/sharpen the pencil
- Carbon steel can be hardened, unlike aluminium which can only be work hardened/alloyed