

## 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
- For the multiple choice questions, circle your 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.**

**(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

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 it 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