Design & Technology
A-Level

Alloying
Multiple Choice

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. Which one of the following materials is an alloy?

A Copper ☐

B Zinc ☐

C Brass ☐

Q2. How are particles bonded together in metals?

A Covalent bonds ☐

B Attractive forces between positive and Negative ions ☐

C Attractive forces between atoms and delocalised electrons ☐

Q3. What is an alloy?

A A mixture of 2 or more elements, where at least 1 is a metal ☐

B A mixture of 3 or more elements, where at least 1 is a metal ☐

C A compound of 2 or more elements Where at least 1 element is a metal ☐

Q4. Which of these statements about alloys is correct?

A Most alloys are less useful than the Individual elements that they are made from ☐

B Most alloys are harder than the individual Elements that they are made from ☐

C Most alloys are softer than the individual Elements that they are made from ☐

Q5. Which of these materials is an alloy?

A steel ☐

B Iron ☐

C Aluminium ☐

Q6. Carbon steel is made from carbon and which other material?

A Copper ☐

B Iron ☐

C Brass ☐

Q7. Which one of the following is iron alloyed with to make mild steel?

A Zinc ☐

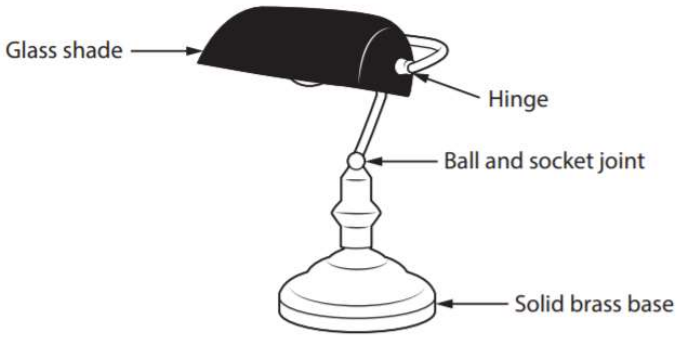
B Carbon ☐

C Aluminium ☐

Q8. Which one of the following not an alloy?

A	Solder	☐
B	Bronze	☐
C	Nickel	☐

Q9. The image below shows a desk lamp.



9a. Give 2 properties of brass that make it suitable for the base of the desk lamp. **(2 marks)**

1. _____

2. _____

9b. Explain one reason why brass is a better choice of material than acrylic for the base of the desk lamp. **(2 marks)**

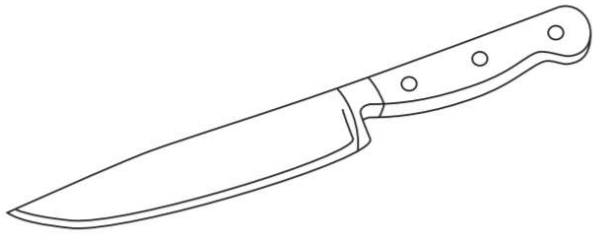
_____

_____

_____

_____

Q10. The drawing below shows a kitchen knife.



10a. The blade of the knife is made from stainless steel. Give 2 properties of stainless steel that make it suitable for the blade of the knife. Justify your answer**(4 marks)**

Property 1:

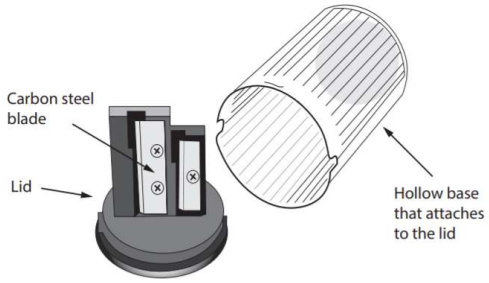
Justification:

Property 2:

Justification:

10b. Cheaper knife blades can be made from carbon steel.
The carbon steel has been hardened.
Describe the process of hardening the knife blade. **(2 marks)**

Q11. The drawing below shows a pencil sharpener



11ai. Give 2 properties of carbon steel that make it suitable for the blade of the pencil sharpener **(2 marks)**

1. _____

2. _____

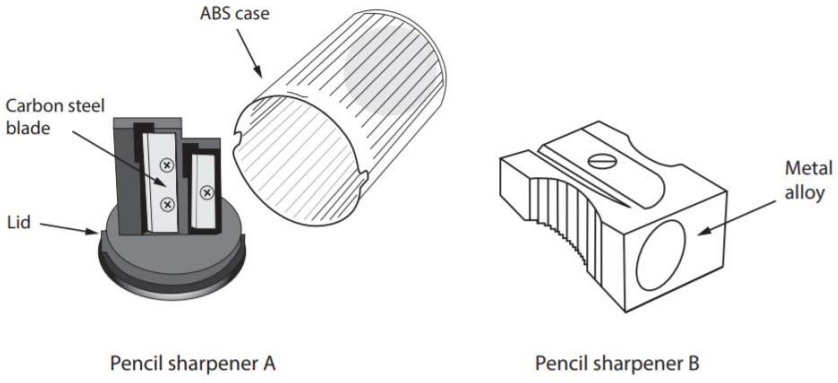
11aii. Describe one reason why carbon steel is a better choice of metal for the blade rather than aluminium **(2 marks)**

_____

_____

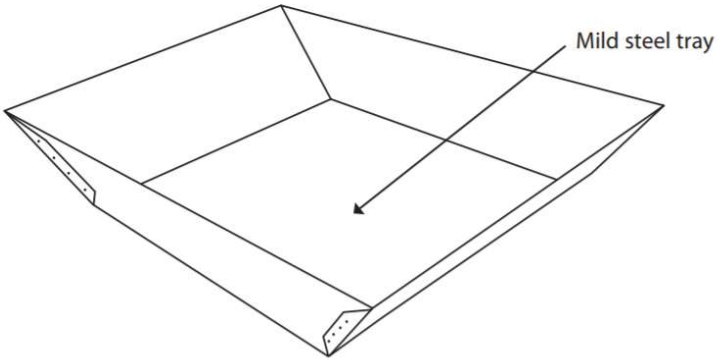
_____

11b. The images below show 2 different types of pencil sharpener



Evaluate pencil sharpener A in comparison to pencil sharpener B in terms of from, materials and components. **(6 marks)**

Q12. The wheelbarrow tray is made from mild steel.



Explain 2 advantages of making the wheelbarrow tray from mild steel. **(4 marks)**

1.

2.

Q13. The picture below shows a high speed steel (HSS) drill bit which has a high carbon content.

Discuss how the carbon content of steel affects its properties **(3 marks)**

Q14. Complete the table by naming the correct metal from the list below to match each description

Metal steel cast iron copper stainless steel brass aluminium

Metal	**Description**
	Hard, tough, used to make sink units
	Hard, brittle, used to make metalwork vices
	Lightweight, resists corrosion, used to make aircraft bodies

Answers

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

Q9a.

Two properties given from:

- Excellent resistance to corrosion (1)
- Tough (1)
- Can be polished to achieve a high lustre (1)
- Turns well on a lathe/machinability (1)
- Casts well / good fluidity (1)
- High density / heavy (1)
- Durable (1)
- Good heat resistance (1)
- (Do not accept good conductor of heat /
- electricity / strong)

Q9b.

One reason explained from:

- Brass is heavier (1) therefore the base will be more stable / less likely to fall over (1)
- It is an attractive colour / aesthetic appeal / traditional style lamp (1) whereas acrylic is a more modern material / will not suit style of lamp (1)
- Brass is tougher (1) therefore will withstand knocks and bumps better (1)

Q10a.

Two properties and linked justifications from:

• Property: good resistance to corrosion (1)

• Justification: which means it will not rust / good for food use / dishwasher safe (1)

• Property: hard (1)
• Justification which means it can be ground / keep a sharp edge (1)
• Property: tough (1)
• Justification: which means it will be able to withstand knocks / bumps being dropped (1)

Q10b.

- The blade is **heated** red/cherry/red hot/critical temperature/900 degrees Celsius and then **quenched/dipped** in water
- Blade is heated and dipped into carbon powder, allowed to cool, process repeated several times

Q11ai.

Any 2 properties from:

- Hard
- Ductile
- Malleable
- Toughness

11aii.

One reasons described from:

- Carbon steel is harder (1) which means it wears better/lasts longer (1)
- Carbon steel can have an edge ground on it (1) which means it will be able to cut / shave / sharpen the pencil (1)
- Carbon steel can be hardened (1) unlike aluminium which can only be work hardened / alloyed (1)

11b.

Evaluation to address following issues:

Why is product shaped/styled the way it is?

Pencil sharpener A:

- Big to hold and collect waste
- Able to be taken apart easily so as to be able to empty the ABS case
- Textured ribs moulded into the case
- Two different sized holes to enable different sized diameter pencils to be sharpened
- Bigger and takes up more space

Pencil sharpener B:

- Textured grip on the side to make it easier to hold
- Clear space around the top by the blade to allow shavings to be removed as they come off the pencil
- Has finger and thumb recesses to enable a secure grip
- Tapered shape follows the form of the conical pencil tip

- Smaller than A but likely to get lost

Materials and components

Pencil sharpener A:

- Could have a clear / transparent waste collection unit so as to see when it is full
- Blades that can be replaced when they are blunt
- Injection moulded components can be coloured at the manufacturing stage
- Multiple materials
- ABS case prone to cracking

Pencil sharpener B:

- Low melting alloy for die casting
- Fine detail moulded into product as a result of material and process
- Replaceable blade
- Self-finishing as a result of the process used
- Single material
- Robust / unlikely to break

Q12.

Two advantages explained from:

• No expensive mould/machine is required (1) which means that it will be cheaper (1)

• Easy to recycle (1) which means less likely to be thrown away/added to landfill (1)

• Easy to make different shapes and sizes (1) because there is no mould (1)

• Bits can be pressed/stamped out (1) and then joined easily by welding/riveting (1)

• Mild steel is tough (1) which means it can withstand knocks / bumps(1)

• Mild steel is hard (1) which means it can withstand wear (1)

• Easily welded (1) can be repaired/patched up (1)

• High compressive strength (1) makes it capable of taking/carrying weight (1)

• Relatively cheap (1) keeps material costs down (1)

• Widely/readily available (1) making is easy to get (1)

• Malleable (1) which means it can be pressed/folded into shape (1)

Do not accept 'Strong' or 'Durable'.

Q13.

Answers related to:

- Mild, Medium-carbon and High-carbon steels.

- % of carbon added to steel.
- Usage of steel in products – drills, chisels, knives, etc.
- Case hardening.

No answer or incorrect answer. 0 mark

Appropriate discussion point but lacking detail award 1 mark
e.g. adding carbon makes the steel harder.

Appropriate discussion, includes some detail award 2 marks
e.g. adding carbon makes the steel harder but too much will make it brittle.

Appropriate discussion, well detailed award 3 marks
e.g. high carbon steel is very hard but also less ductile, tough and malleable.

Q14.

1. Stainless steel
2. Cast iron
3. aluminium