**Design & Technology**

**AQA A-Level** Logo

Description automatically generated with low confidence

**Performance characteristics of metals**

**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.** Which ferrous metal is commonly used for engine blocks and manhole covers due to its high compressive strength?

**A** Low carbon steel

**B** Stainless steel

**C** Cast iron

**Q2.** What property makes stainless steel suitable for cutlery and surgical instruments?

**A** High thermal conductivity

**B** Corrosion resistance

**C** Magnetic properties

**Q3.** Die steel (tool steel) is a ferrous alloy known for its:

**A** High hardness and wear resistance

**B** Electrical conductivity

**C** Flexibility

**Q4.** Pewter, a non-ferrous alloy, is often used for:

**A** Food packaging

**B** Decorative items and tableware

**C** Electrical components

**Q5.** Explain why high speed steel would be a suitable material for a metal drill bit **(6 marks)**

**Q6.** Complete the table below to show the appropriate classification for each of the four metals by putting a cross (x) in the correct box **(4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Metal** | **Ferrous metal or ferrous alloy** | **Non-ferrous metal** | **Non-ferrous alloy** |
| Stainless steel |  |  |  |
| Copper |  |  |  |
| Bronze |  |  |  |
| Low carbon steel |  |  |  |

**Answers**

**Q1**. C

**Q2**. B

**Q3**. A

**Q4**. B

**Q5**.

* HSS is an extremely hard material that resists abrasion and wear, maintaining a sharp cutting edge on the drill bit.
* HSS is capable of withstanding the high temperatures caused by the friction of cutting, without losing its hardness.
* Its resistance to wear allows it to drill other metals at high speeds.
* HSS is an alloy containing chromium that is highly resistant to corrosion allowing HSS drill bits to be used with a variety of lubricants and cutting compounds.
* HSS can be coated to improve its performance. A titanium nitride coating can be used to further reduce friction and improve performance

**Q6.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Metal** | **Ferrous metal or ferrous alloy** | **Non-ferrous metal** | **Non-ferrous alloy** |
| Stainless steel | x |  |  |
| Copper |  | x |  |
| Bronze |  |  | x |
| Low carbon steel | x |  |  |