EXERCISE 1.3

MODULE 1 TOPIC 1
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Gr 10 Physical Sciences 3-in-1

QUESTION 1

1.1 Briefly describe a practical method that can be used to determine:

1.1.1 if a material is magnetic

1.1.2 which of two materials (if any) is the better thermal conductor

1.2 What influence does heating have on electrical conductivity of:

1.2.1 metals 1.2.2 metalloids

QUESTION 2

2.1 Complete **2.1.1** to **2.1.12** in the table below by adding **YES** or **NO** to identify the properties of the materials listed.

Material	Magnetic	Thermal conductor	Electrical conductor	Pure substance
stainless steel	**2.1.1**	YES	**2.1.2**	**2.1.3**
paper	NO	**2.1.4**	NO	NO
iron	**2.1.5**	YES	**2.1.6**	**2.1.7**
copper	**2.1.8**	YES	**2.1.9**	**2.1.10**
polystyrene	NO	**2.1.11**	**2.1.12**	YES

2.2 Answer the following questions based on the information in the table.

2.2.1 Give ONE use for stainless steel.

2.2.2 Select a material which would be suitable to make electrical wiring from. Give TWO reasons for your answer.

2.2.3 Select a material that will be the most efficient to prevent frozen food for a couple of hours from melting.

2.2.4 Consider a sheet of printing paper. Classify it as an element, compound or mixture.

2.2.5 Name ONE material that is not an element or a compound, but can be regarded as a solution. Give the special name for the group of materials to which it belongs.

2.2.6 Describe a practical method to determine which materials are electrical conductors.

2.2.7 Does polystyrene have a low or a high density? Explain your answer by referring to how the density of a substance is determined.

QUESTION 3

Study the table with the thermal conductivity coefficient at room temperature of various materials below and answer the questions that follow.

Material	Thermal conductivity coefficient (W/mK)	Material	Thermal conductivity coefficient (W/mK)
diamond	2200	silver	419
aluminium	239	steel (mild)	50
brass	96	steel (stainless)	25
cobalt	69	zinc	113
copper	386	water	0,58
gold	310	air	0,024
iron (pure)	80	wood	0,15
lead	35	polystyrene	0,03
magnesium	151	glass	1,05

3.1 Name TWO metals that are good thermal conductors and will be efficient to use as conducting wire in an electrical circuit.

3.2 Suggest ONE reason why silver would not generally be used as a conducting wire in an electrical circuit.

3.3 Name TWO materials that are very good heat insulators.

3.4 Name the advantage of wooden shutters in comparison to aluminium shutters in front of your windows.

3.5 Name TWO precautions you can take to keep your house cool in the summer and warm in the winter.

3.6 Is water a good thermal conductor or not? Motivate your answer by referring to the role of the layer of ice that forms on lakes and ponds in polar regions.

EXERCISE ANSWERS

QUESTION 1

1.1.1 Hold the material close to a permanent magnet. If it is attracted by the magnet, the material is magnetic.

1.1.2
- Put a small amount of bees wax/candle wax onto the one end of each material.
- Use tongues to hold the other end of the material (without the wax) into a beaker with hot water.
- The material that takes the shortest time for the wax to melt, is the better thermal conductor.

1.2.1 The electrical conductivity of metals decreases

1.2.2 The electrical conductivity of metalloids increases

QUESTION 2

2.1.1 no	2.1.2 yes	2.1.3 no
2.1.4 no	2.1.5 yes	2.1.6 yes
2.1.7 yes	2.1.8 no	2.1.9 yes
2.1.10 yes	2.1.11 no	2.1.12 no

2.2.1
- **Cutlery** – knives, forks, spoons
- **Cookware** – pots, pans, kitchen sinks
- **Appliances** – fridges, dishwashers, stoves, kettles
- **Fittings** – handrails, taps, door handles *(any one use)*

2.2.2 Copper; It is an excellent conductor of electricity; it is ductile and malleable; strong and durable; corrosion resistant *(any two reasons)*

2.2.3 polystyrene 2.2.4 mixture 2.2.5 stainless steel; alloys

2.2.6
- Connect a cell, light bulb (or ammeter) and connecting wires to construct a simple circuit.
- Connect each of the materials into test gap between the wires, one at a time.
- If the light bulb lights up (ammeter shows a reading), the material is an electrical conductor.

2.2.7 low density
- Density $= \frac{\text{mass}}{\text{volume}}$
- Polystyrene has a large volume compared to its small mass due to the many air spaces/gaps between its molecules.
- A small mass divided by a large volume gives a low density.

QUESTION 3

3.1 silver, copper

3.2
- it is very expensive
- it tarnishes easily
- it is not as strong as e.g. copper *(any one reason)*

3.3 polystyrene; air

3.4
- Wood is a good heat insulator, while aluminium is a thermal conductor.
- Wooden shutters help keep rooms warmer in winter by blocking heat from escaping, and cooler in summer by blocking heat from entering.

3.5
- Insulate the roof, walls, and windows to keep heat out in summer and trap warmth in winter.
- Control sunlight and ventilation during the day by closing windows and curtains in summer (to block heat out) and opening them in winter (to let heat in).

3.6 Water is a poor conductor of heat. The ice layer on top of lakes acts as an insulator, preventing the rest of the water from freezing and protecting aquatic life in polar regions.