



Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. lodestone
2. electromagnet
3. magnetic saturation
4. demagnetization
5. geomagnetism
6. magnetic declination
7. kilowatt-hours
8. MCB

K • 4

Each carries 0.5 mark.

2 Label the diagram

- | | |
|-----------------------|-------------------------------|
| 1. electric meter | 4. MCBs |
| 2. main switch | 5. earth plate in damp ground |
| 3. distribution board | 6. earth wire |

K • 3

Each carries 0.5 mark.

3 Multiple choice

- i. c. lodestone

K • 1

Lodestone (magnetite) is found in nature already magnetized. Nickel is a magnetic material, not a magnet; an electromagnet is made by people; limestone isn't magnetic at all.

- ii. d. the live wire

K • 1

The switch goes in the live wire, so that when it is off, no part of the appliance is connected to the live supply.

- iii. c. three, one on each piece

U • 1

Each piece still has its molecular magnets lined up, so each piece is a complete magnet with a north and a south pole: three N-poles and three S-poles. A pole on its own has never been found.

- iv. b. the alloy melts at a low temperature

U • 1

A fuse must melt before the house wiring gets dangerously hot. The tin-lead alloy melts at a low temperature (about 200 °C); copper melts only at 1,085 °C.

- v. c. at a magnetic pole

U • 1

At a magnetic pole the field lines go straight down into the Earth, so the needle points straight down: the angle of dip is 90°. At the magnetic equator it lies flat (0°); in Kathmandu it tilts at about 44°.

4 Very short answers

- a. MARKING SCHEME

K • 1

✓ Any two of: iron, cobalt, nickel, steel (or another alloy of them).

- b. MARKING SCHEME

K • 1

✓ 0° (the needle lies flat).

- c. MARKING SCHEME

A • 1

✓ $2 \text{ kW} \times 0.5 \text{ h} = 1 \text{ unit (1 kWh)}$.



5 Short answers

a. MARKING SCHEME

U · 2

- ✓ In a magnet the molecular magnets are lined up in open chains; each blow jolts them out of line.
- ✓ They end up in random directions or closed chains, their effects cancel, and the magnetism is lost.

b. MARKING SCHEME

U · 2

- ✓ A dip needle lines up with the Earth's magnetic field lines.
- ✓ At the magnetic poles the field lines go straight down into (or up out of) the Earth, so the needle stands vertical, at 90° to the horizontal.

c. MARKING SCHEME

U · 2

- ✓ The live wire is the one at a high voltage (about 230 V).
- ✓ When a fuse in the live wire blows, the appliance is cut off from the live supply and is safe to touch; in the neutral wire it would stay joined to the live supply.

d. MARKING SCHEME

U · 2

- ✓ Any one difference, e.g. the live wire brings the current from the supply; the neutral wire takes it back.
- ✓ Any second difference, e.g. live is at about 230 V, neutral at about 0 V; touching live gives a dangerous shock; switches and fuses go in the live wire only; live red or brown, neutral black or blue.

6 Long answers

a. ANSWER

K · 4

The theory was given by Wilhelm Weber and improved by James Alfred Ewing. Every magnet and magnetic material is made of tiny molecular magnets, each with a north and a south pole. In an unmagnetized material they form closed chains, so their poles cancel. When they line up in open chains, all pointing the same way, the material becomes a magnet, with free north poles at one end and free south poles at the other. When all of them are lined up, the magnetism is the greatest possible: magnetic saturation.

MARKING SCHEME

- ✓ Every magnet and magnetic material is made of tiny molecular magnets, each with a north and a south pole.
- ✓ In an unmagnetized material they form closed chains, so their poles cancel.
- ✓ Lined up in open chains, all pointing the same way, they make the material a magnet (N-pole at one end, S-pole at the other).
- ✓ When all are lined up, the material reaches magnetic saturation.

b. ANSWER

U · 4

Earthing is joining the metal bodies of appliances (and the earth pins of sockets), by a low-resistance earth wire, to a metal plate buried in damp ground, so that any leaking current flows safely into the ground.

It is necessary because if a live wire inside an appliance touches its metal body, the body becomes live. With earthing, a large current flows into the ground at once, the fuse blows or the MCB trips, and the appliance is cut off. This protects people from electric shocks, and protects appliances and the wiring from damage and fire.

MARKING SCHEME

- ✓ Earthing is joining the metal bodies of appliances, by an earth wire, to a metal plate buried in damp ground.
- ✓ If a live wire inside an appliance touches its metal body, the body becomes live.
- ✓ With earthing, a large current flows into the ground at once, and the fuse blows or the MCB trips.
- ✓ This protects people from electric shocks, and the appliances and wiring from damage and fire.



7 Numerical problems

a. ANSWER

A · 2

Units in 30 days = $75 \times 2 = 150$ units. Bill = $150 \times \text{Rs } 9.50 = \text{Rs } 1,425$.

MARKING SCHEME

- ✓ Units in 30 days = 150.
- ✓ Bill = $150 \times 9.50 = \text{Rs } 1,425$.

b. ANSWER

A · 2

$P = 25 \text{ W} = 0.025 \text{ kW}$, $N = 8$, $t = 4 \text{ h } 40 \text{ min} = 14/3 \text{ h} \approx 4.667 \text{ h}$. E.C. = $P \times N \times t = 0.025 \times 8 \times 14/3 \approx 0.933$ units.

MARKING SCHEME

- ✓ $P = 0.025 \text{ kW}$ and $t = 4.667 \text{ h}$ used in E.C. = $P \times N \times t$.
- ✓ About 0.93 units.

c. ANSWER

A · 3

Units a day = $1.5 \times 14 \times 6.5 = 136.5$ units. Units a month = $136.5 \times 30 = 4,095$ units. Bill = $4,095 \times \text{Rs } 12.50 = \text{Rs } 51,187.50$.

MARKING SCHEME

- ✓ Units a day = $1.5 \text{ kW} \times 14 \times 6.5 \text{ h} = 136.5$.
- ✓ Units a month = $136.5 \times 30 = 4,095$.
- ✓ Bill = $4,095 \times 12.50 = \text{Rs } 51,187.50$.

8 Think

ANSWER

HA · 2

The Tihar bulbs are joined in series: there is only one path, so taking out one bulb breaks it and the current stops in all of them. House bulbs are in parallel: each has its own path between the live and neutral wires, so losing one doesn't affect the others.

MARKING SCHEME

- ✓ The Tihar bulbs are in series: one path, so removing one bulb breaks the circuit for all.
- ✓ House bulbs are in parallel: each has its own path between live and neutral, so the others keep working.

9 Activity: The properties of a magnet (Activity 8.1)

(not marked)

WHAT STUDENTS SHOULD FIND

It settles pointing north-south. The pins cling to the ends, hardly any to the middle. N near N: it turns away (like poles repel). S near N: it swings towards the other magnet (unlike poles attract).

See it at Science Playground

Exhibits and plants at the center, Bhaktapur, that go with this unit. Book a class visit at science-playground.com/booking.

- **Magnetic Lines of Force** (exhibit): The nails line up round the central magnet, showing the shape of its field.
- **How Far Can a Magnet Pull?** (exhibit): See how far through open air the hanging magnet can still pull.
- **Earth's Magnetic Field** (exhibit): Find Nepal on the world map of declination: here a compass points almost exactly north.
- **The Fun Circuit** (exhibit): Follow the closed loop that lights the drawn lamp; break it and the lamp goes dark.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	15	15	8	2	40

