| Surname | Initial(s) |
| --- | --- |
| Signature | |

Paper Reference(s)

**5009 5045**

# Edexcel GCSE

## Science (5009)

## Physics (5045)

P1a – Topics 9 and 10

**Foundation and Higher Tier**

Friday 20 June 2008 – Morning

Time: 20 minutes

| Materials required for examination | Items included with question papers |
| --- | --- |
| Multiple Choice Answer Sheet<br>HB pencil, eraser and calculator | Nil |

### Instructions to Candidates

Use an HB pencil. Do not open this booklet until you are told to do so.
Mark your answers on the separate answer sheet.

**Foundation tier candidates:** answer questions 1 – 24.
**Higher tier candidates:** answer questions 17 – 40.
All candidates are to answer questions 17 – 24.

**Before the test begins:**

Check that the answer sheet is for the correct test and that it contains your candidate details.

**How to answer the test:**

For each question, choose the right answer, A, B, C or D and mark it in HB pencil on the answer sheet.
For example, the answer C would be marked as shown.

| A | B | ● | D |
| --- | --- | --- | --- |

Mark only **one** answer for each question. If you change your mind about an answer, rub out the first mark **thoroughly**, then mark your new answer.

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*Turn over*

**Questions 1 to 16 must be answered by Foundation tier candidates only.**
**Higher tier candidates start at question 17.**

## Batteries in action

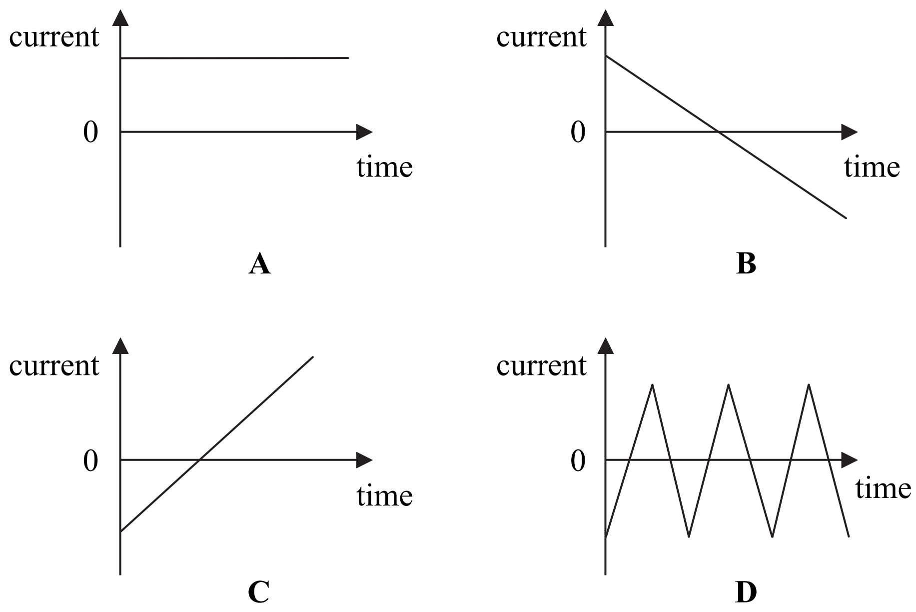
**1.** Rechargeable batteries are useful because

**A** they use free energy
**B** they give alternating current
**C** they are always ready to use
**D** they can be used more than once

**2.** The capacity of a battery is measured in

**A** volts
**B** ohms
**C** amp-hours
**D** volt-minutes

**3.** Which of these shows the current from the battery in a torch?

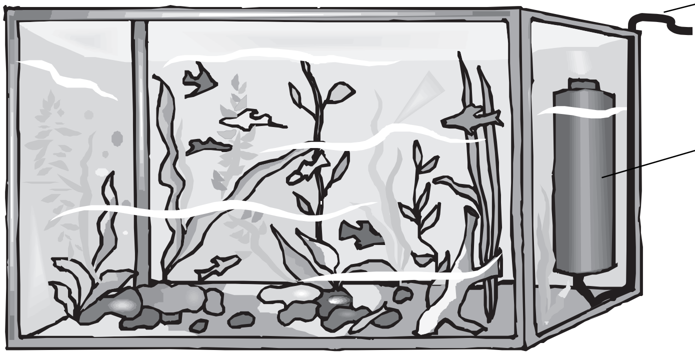



**4.** Which of these does **not** use a battery?

**A** a dynamo
**B** a mobile phone
**C** an electric car
**D** an MP3 player

**Alan's fish tank**

Alan keeps tropical fish.




He uses a solar cell to power the electric motor that turns the pump.

**5.** The solar cell obtains its energy from

**A** thermal (heat) energy
**B** light energy
**C** chemical energy
**D** tidal energy

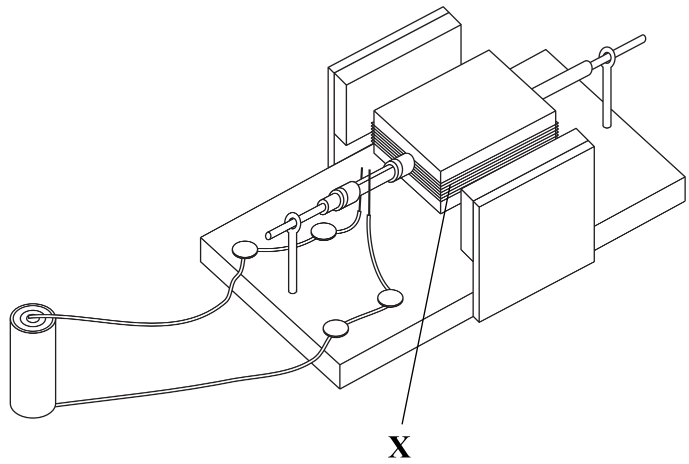
**6.** The power of the pump is the rate of transfer of

**A** current
**B** energy
**C** voltage
**D** electrons

**7.** The efficiency of the pump will increase if

**A** more fish are put in the tank
**B** the resistance of the motor's coil increases
**C** energy losses are reduced
**D** the wasted energy increases

**8.** The diagram shows a model electric motor.




Part **X** is

**A** a magnet
**B** an axle
**C** a coil
**D** a battery

**9.** Alan wants to keep the water in the fish tank warm.
He uses a circuit which switches on a heater when the water becomes too cold.
The circuit works because of the change in the resistance of

**A** a fuse
**B** a thermistor
**C** an earth wire
**D** a light dependent resistor (LDR)

**10.** The heater must be fitted with an earth wire.
The earth wire, together with the fuse, is designed to

**A** reduce the current used
**B** reduce the voltage used
**C** protect the heater
**D** protect Alan

**11.**

| cost = power × time × cost of 1 kW h |
|---|

The power of the heater is 50 W (0.05 kW).
Electricity costs 20 p per kW h.
What is the cost of using the heater continuously for two hours?

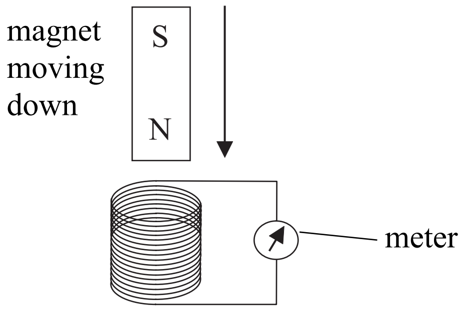
**A** 2 p
**B** 5 p
**C** 50 p
**D** 2000 p

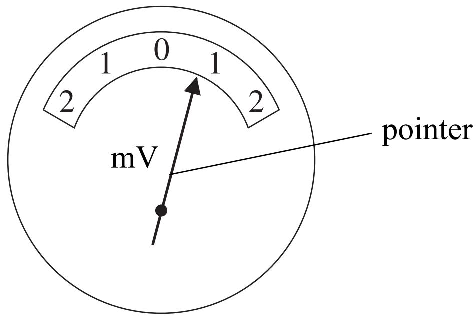
**12.** Alan uses a lamp to light the fish tank.
He replaces a filament lamp with an energy-saving lamp.
The energy-saving lamp is more efficient because it reduces

**A** the amount of heat produced
**B** the brightness of the light
**C** the price of the lamp
**D** the voltage used

## John makes electricity

John and four friends investigate the effect of moving a magnet into a coil of wire.
John drops a magnet into a coil from a height of 50 cm.




close up view of meter

**13.** John could make the pointer in the meter move in the opposite direction by

- **A** moving the magnet into the coil faster
- **B** moving the magnet into the coil more slowly
- **C** leaving the magnet in the coil
- **D** pulling the magnet out of the coil

**14.** Carla moves the north pole of the magnet into and out of the coil at different speeds.
John suggests dropping the magnet from different heights to change the speed.
His four friends comment on this plan.

I think we should repeat the experiment and take more readings.

Abel

The reading will be double if we double the height.

Boris

We should drop the magnet from 20, 40, 60, 80 and 100 cm.

Carla

The highest voltage we can measure with this apparatus is 2 mV.

Davina

Who has made a prediction?

- **A** Abel
- **B** Boris
- **C** Carla
- **D** Davina

**15.** John takes three readings of the voltage for each height.
This makes the investigation

**A** more valid
**B** more varied
**C** more reliable
**D** cover a larger range

**16.** John decides to plot a graph of his results. He records the three voltages for a particular height as

1.5 mV 0.6 mV 1.5 mV

When he plots the point for this height on a graph, the value of voltage he should use is

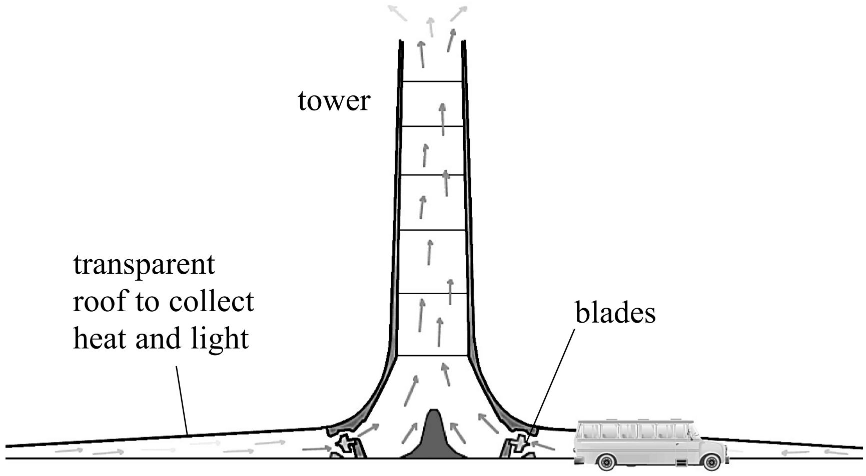
**A** 0.6 mV
**B** 1.2 mV
**C** 1.5 mV
**D** 3.6 mV

**Higher tier candidates start at question 17 and answer questions 17 to 40.**
**Questions 17 to 24 must be answered by all candidates: Foundation tier and Higher tier.**

## A solar tower

A new technology is being developed to convert solar energy into electricity.

- Heat and light from the Sun are absorbed at ground level in a huge collector.
- Warm air is produced and is channelled up the inside of a tall tower.
- The moving air turns blades at the base of the tower.
- The spinning blades turn generators.




**17.** Overall, this process is most like

**A** a motor
**B** a solar cell
**C** a wind turbine
**D** a rechargeable battery

**18.** A generator works when a magnet rotates inside

**A** a battery
**B** a coil
**C** a voltmeter
**D** a thermistor

**19.** Shah and Tim are talking about the solar tower system.

The solar tower uses renewable energy.

Shah

The solar tower will produce energy continuously.

Tim

Who is correct?

**A** Shah only
**B** Tim only
**C** both Shah and Tim
**D** neither

**20.** Shah compared a single wind turbine with the solar tower and collector.
When they are both working, the solar tower system will

**A** have fewer moving parts
**B** cover more land
**C** waste less electric current
**D** produce more global warming

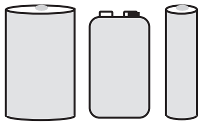
**21.**

| power = current × voltage |
|---|

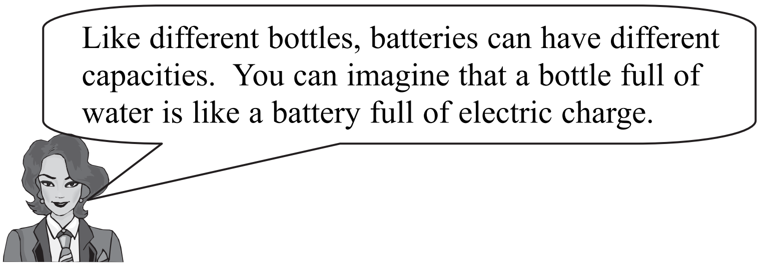
A solar tower could provide a current of 1000 A at a voltage of 200 000 V.
What power would it produce?

**A** 200 kJ
**B** 200 kW
**C** 200 MJ
**D** 200 MW

**Bottles and battery capacity**



Anne's teacher was explaining the idea of battery capacity.




Her teacher filled four bottles with water.
She poured all the water out of each bottle in turn.
She poured at different speeds and for different times.

**22.** Which row of the table is for the bottle with the greatest capacity?

| | **rate of pouring (ml/s)** | **time to empty bottle (s)** |
|---|---|---|
| **A** | 50 | 5 |
| **B** | 50 | 10 |
| **C** | 100 | 5 |
| **D** | 100 | 10 |

**23.** In this model, the rate of flow of water from a bottle represents

**A** the current from a battery
**B** the voltage of a battery
**C** the power of a battery
**D** the energy from a battery

**24.** For electricity in a wire, each millilitre (ml) of water represents a number of

**A** positive electrons
**B** positive protons
**C** negative electrons
**D** negative protons

**TOTAL FOR FOUNDATION TIER PAPER: 24 MARKS**

**Foundation tier candidates do not answer any more questions after question 24.**

**Questions 25 to 40 must be answered by Higher tier candidates only.**
**Foundation tier candidates do not answer questions 25 to 40.**

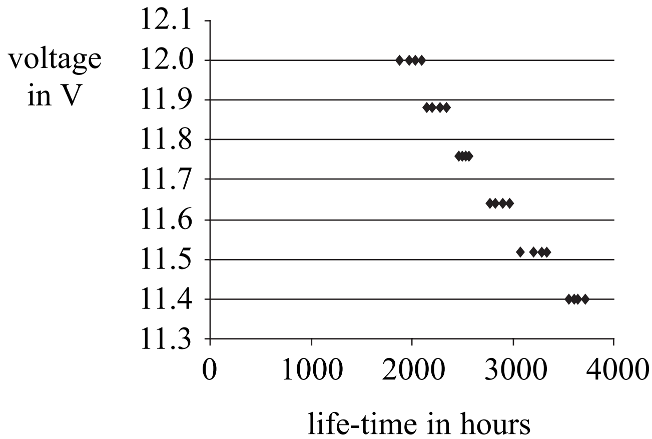
## Ali investigates lamps

Ali works in a laboratory.
He investigates for how long 12 V filament lamps last (their life-time).
He uses different voltages across the lamps.
He finds the life-time, in hours, for each voltage.

**25.** For his experiment, Ali needs to use

**A** an ammeter and a clock
**B** an ammeter and a voltmeter
**C** a voltmeter and a clock
**D** a voltmeter, an ammeter and a clock

**26.** Ali investigates identical lamps using different voltages.
Here are four results for each voltage he uses.

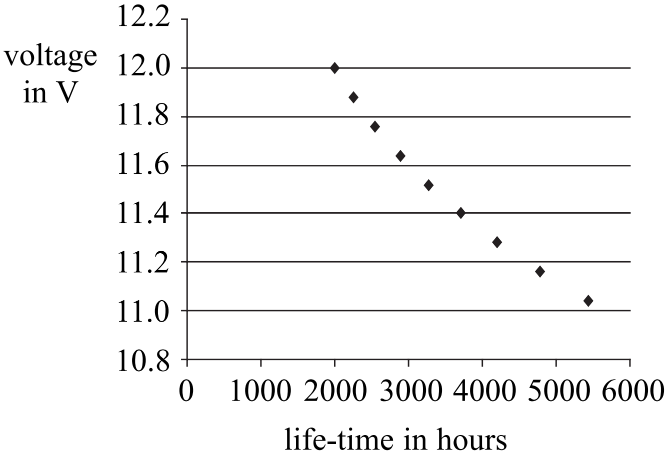



Ali's most **reliable** value for a life-time is for a voltage of

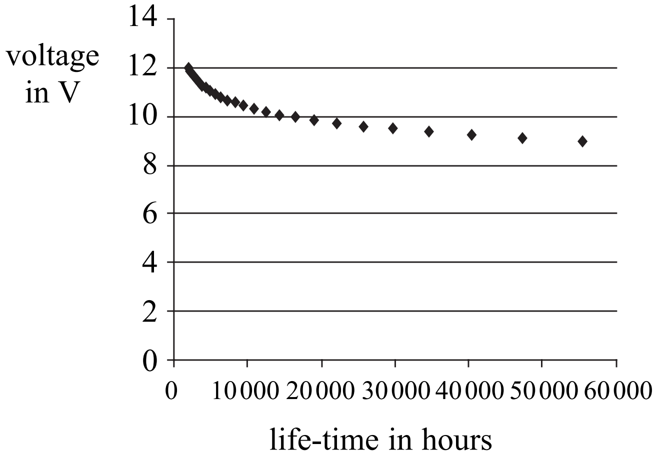
**A** 12.00 V
**B** 11.88 V
**C** 11.76 V
**D** 11.40 V

***Use this information to answer questions 27 and 28.***

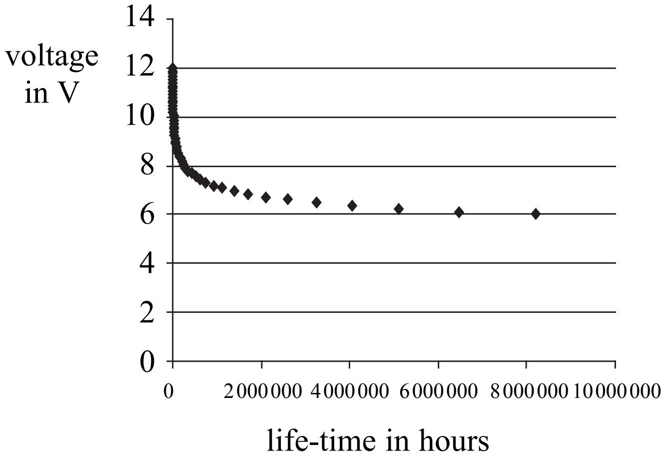
Ali uses a computer to plot graphs of his results.
The computer estimates the life-times for lower voltages.
The graphs from the computer are shown below.



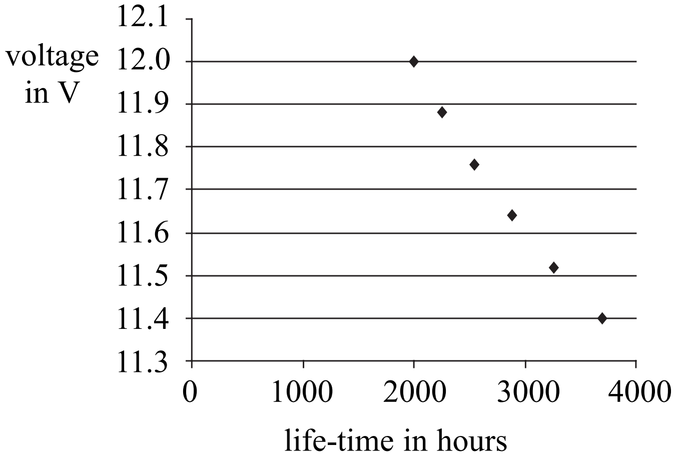

**P**




**Q**




**R**




**S**

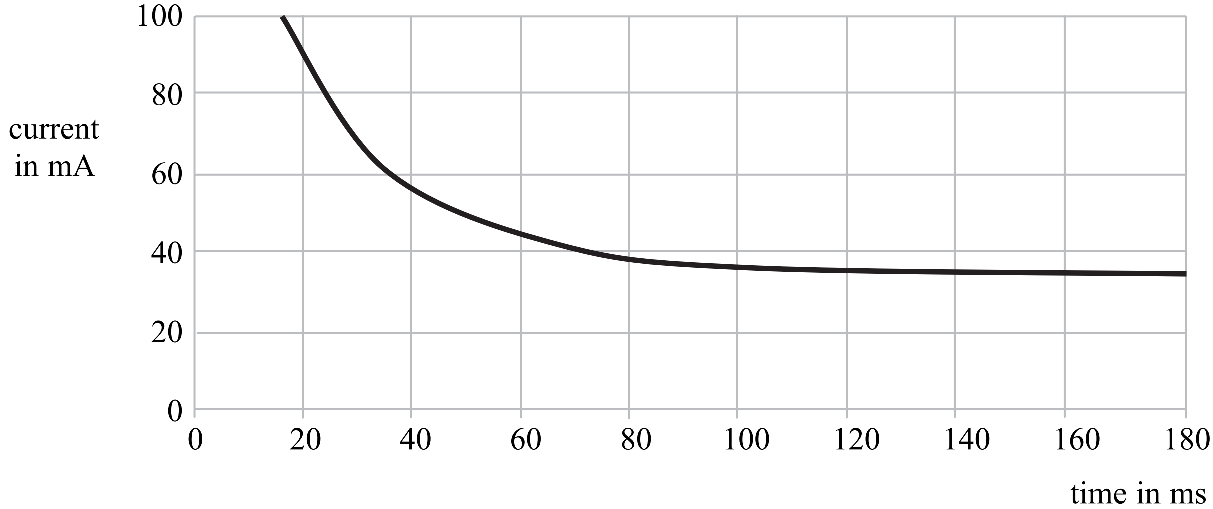
**27.** Ali has made an error with his graphs.
The x-axis should show the voltage because

**A** voltage is the dependent variable
**B** voltage is the independent variable
**C** voltage is the control variable
**D** voltage is constant

**28.** Ali wants to find the life-time for a voltage of 11.55 V.
The best graph to use is

**A** graph **P**
**B** graph **Q**
**C** graph **R**
**D** graph **S**

**29.** Ali finds this data on the Internet.
It shows how the current in a filament changes after the lamp is switched on.



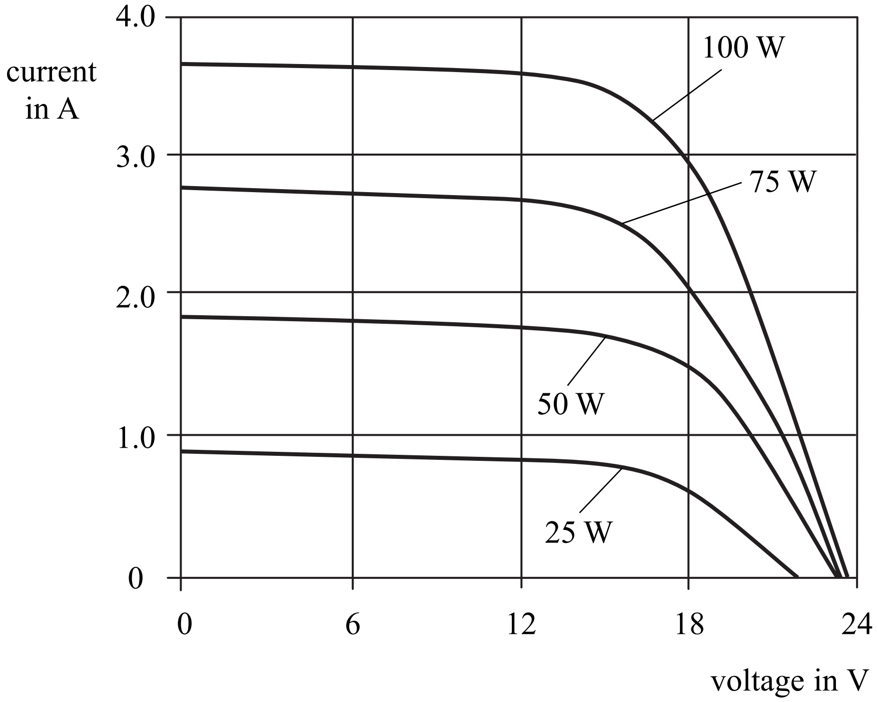

Ali wants to check another filament lamp himself.

He decides to use a datalogger for his experiment.
He needs to use a datalogger because

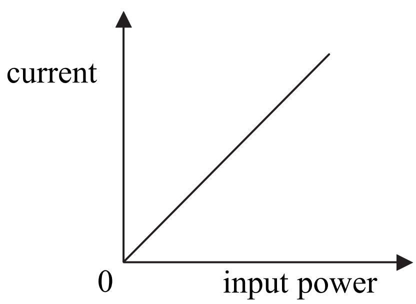
**A** the current in the lamp is very small
**B** the lamp is not very powerful
**C** the current in the lamp becomes constant
**D** the readings must be taken very quickly

## Photoelectric cells

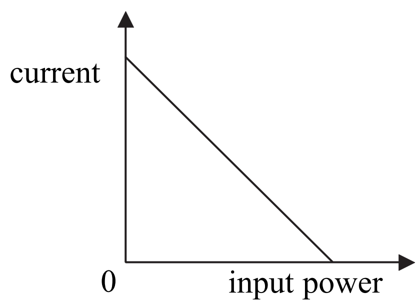
The graph shows current and voltage values for a solar panel for different powers of light input.



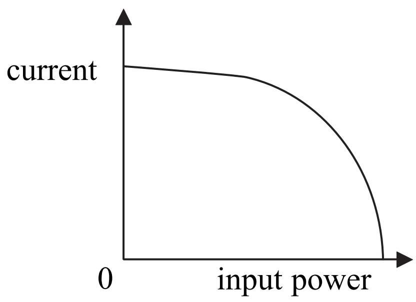

**30.** Which of these graphs best shows how the current varies with the input power for a constant voltage of 6 V?



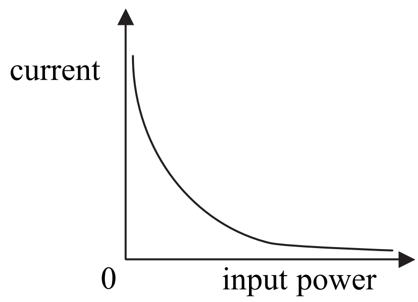

**A**




**B**




**C**

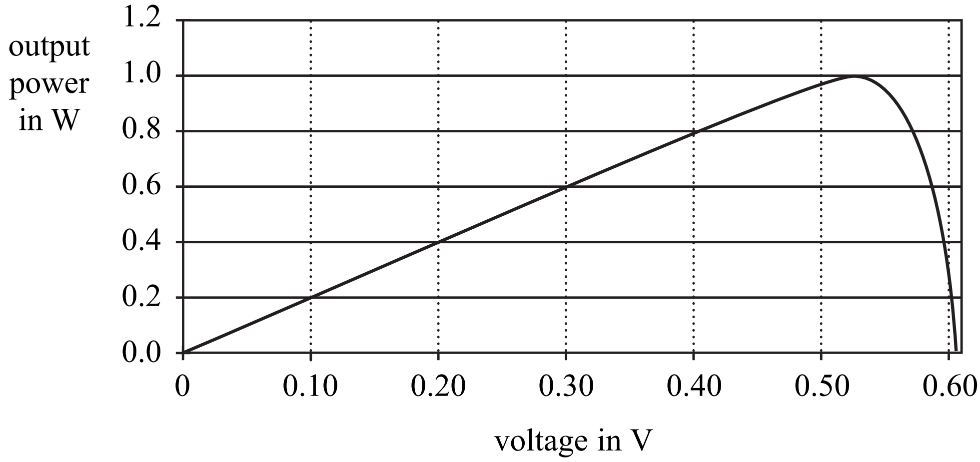



**D**

**31.**

$$\boxed{\text{power} = \text{current} \times \text{voltage}}$$

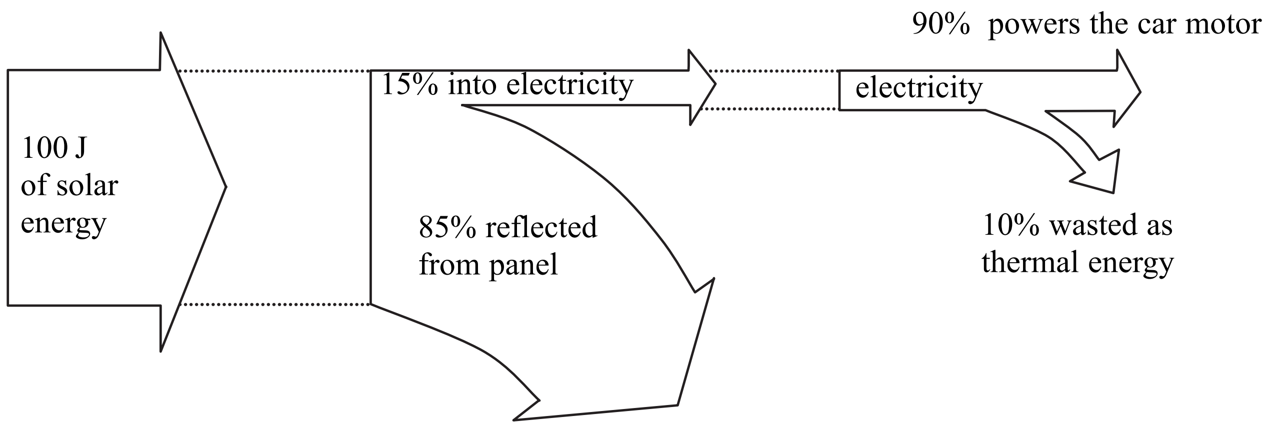
The graph shows how the output power varies with the voltage for a solar cell.




What is the current from this cell at 0.40 V?

**A** 0.5 A
**B** 2 A
**C** 800 A
**D** 3200 A

**32.** A solar panel powers an electric car.
The diagram shows what happens to solar energy incident on the solar panel.




How much of the original energy is wasted in the car?

**A** 1.5 J
**B** 10.0 J
**C** 13.5 J
**D** 86.5 J

## Flying trains?

33. Maglev trains are faster than normal trains because

**A** they can carry more passengers in each carriage
**B** reduced friction increases efficiency
**C** they stop at more stations
**D** the passengers need less heating to keep warm

34. Which row of the table describes what happens when the coil of an electromagnet becomes a superconductor?

| | **resistance** | **current** |
|---|---|---|
| **A** | increases | increases |
| **B** | increases | decreases |
| **C** | decreases | decreases |
| **D** | decreases | increases |

35.

$$\text{efficiency} = \frac{\text{useful output}}{\text{total input}} \times 100\%$$

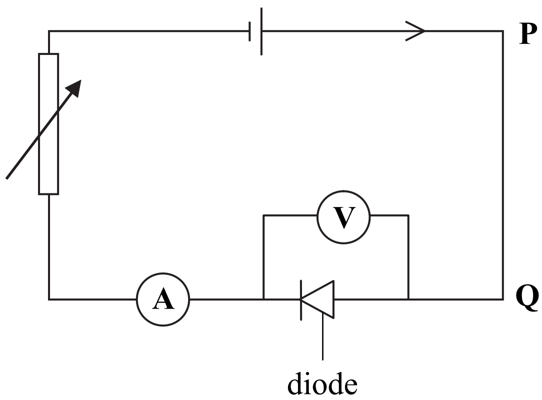
A train is 20% efficient.
How much energy must be put into the train to obtain 1000 J of useful energy?

**A** 20 J
**B** 50 J
**C** 5 000 J
**D** 20 000 J

**Alice meets a diode**

***Use this information to answer questions 36 and 37.***

Alice is given an electrical component called a diode.
She sets up this circuit to investigate some properties of the diode.

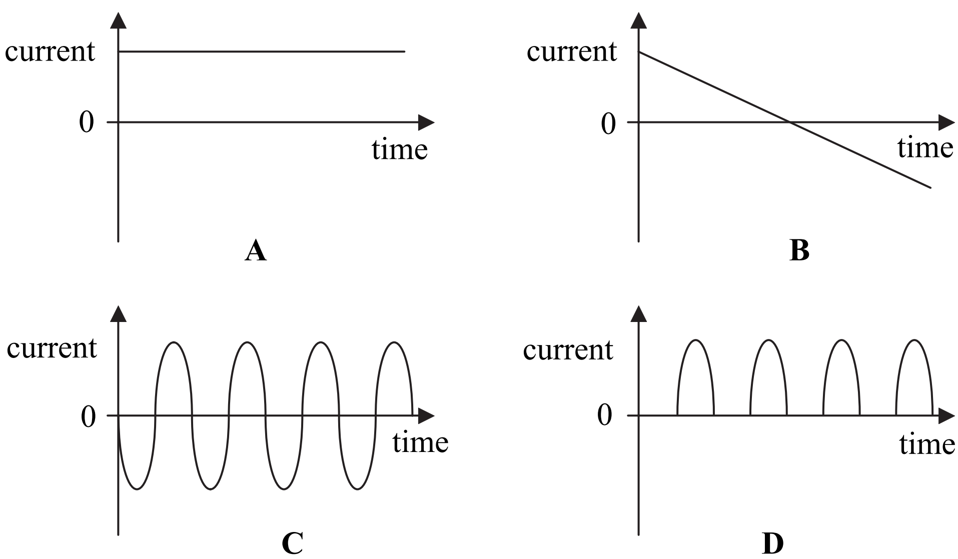



One of the wires is labelled **PQ**.

**36.** Which row of the table correctly describes the movement of particles in wire **PQ**?

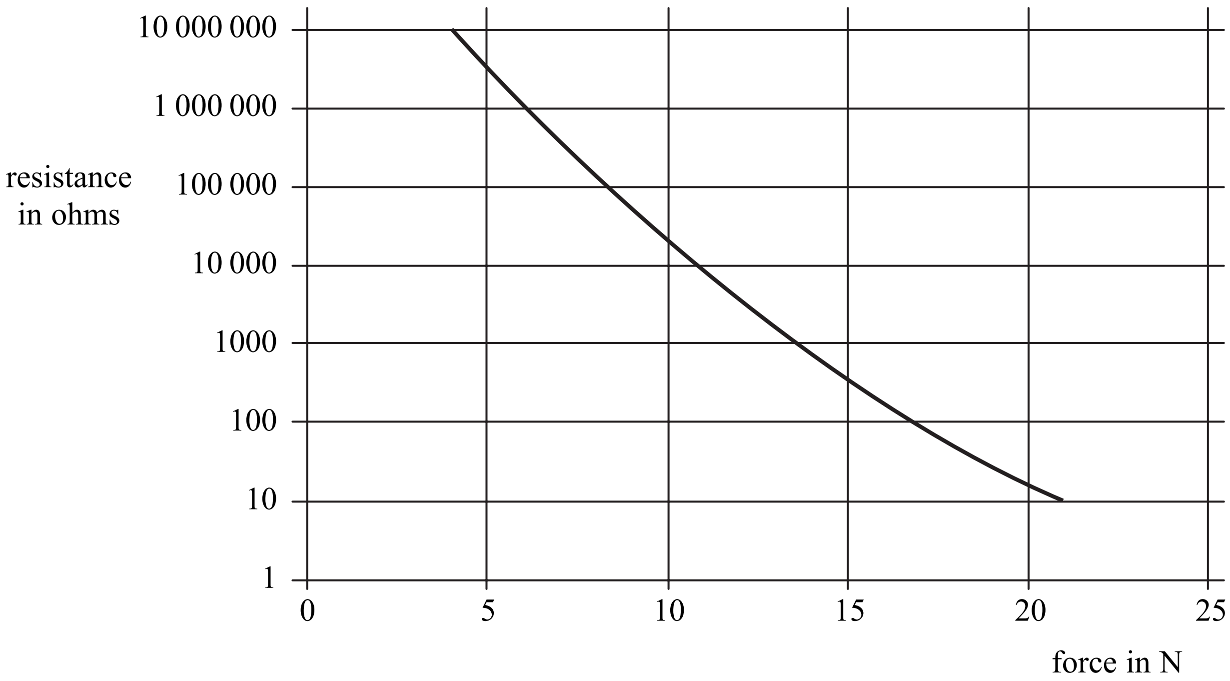
| | **particles flowing** | **direction of particles** |
|---|---|---|
| **A** | positive electrons | from **P** to **Q** |
| **B** | negative electrons | from **P** to **Q** |
| **C** | positive electrons | from **Q** to **P** |
| **D** | negative electrons | from **Q** to **P** |

**37.** A diode affects the current in a circuit.
There **is** a current in the diode when the battery is connected as shown.
There **is no** current in the diode when the battery is reversed.
Alice replaces the battery with an a.c. supply.
Which graph shows the current in the diode?



***Use this information to answer questions 38-40.***

A new material (QTC) has been discovered.
QTC changes its resistance when it is squeezed.
The graph below shows how the resistance of a sample of QTC changes as different forces are applied to it.




**38.** What force is needed for the resistance to become 100 kΩ?

**A** 6 N
**B** 8 N
**C** 11 N
**D** 17 N

**39.** Paul and Jane made statements about the graph.


Who is correct?

**A** Paul only
**B** Jane only
**C** both Paul and Jane
**D** neither

**40.**

| |
|---|
| voltage = current × resistance<br>$V = I \times R$ |

Paul connects a 5 V battery across the sample.
When a force of 21 N is applied, the current is about

**A** 0.5 A
**B** 2 A
**C** 10 A
**D** 42 A

**TOTAL FOR HIGHER TIER PAPER: 24 MARKS**

**END**

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