Paper Reference(s)

5009   5045

Edexcel GCSE

Science (5009)
Physics (5045)

P1a – Topics 9 and 10
Foundation and Higher Tier

Thursday 24 June 2010 – Afternoon

Time: 20 minutes

Materials required for examination	**Items included with question papers**
Multiple Choice Answer Sheet	Nil
HB pencil, eraser and calculator	

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.
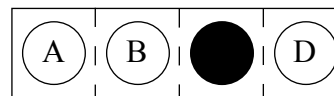All candidates are to answer questions 17 – 24.

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.

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.

Do any necessary calculations and rough work in this booklet. You may use a calculator if you wish.

You must not take this booklet or the answer sheet out of the examination room.
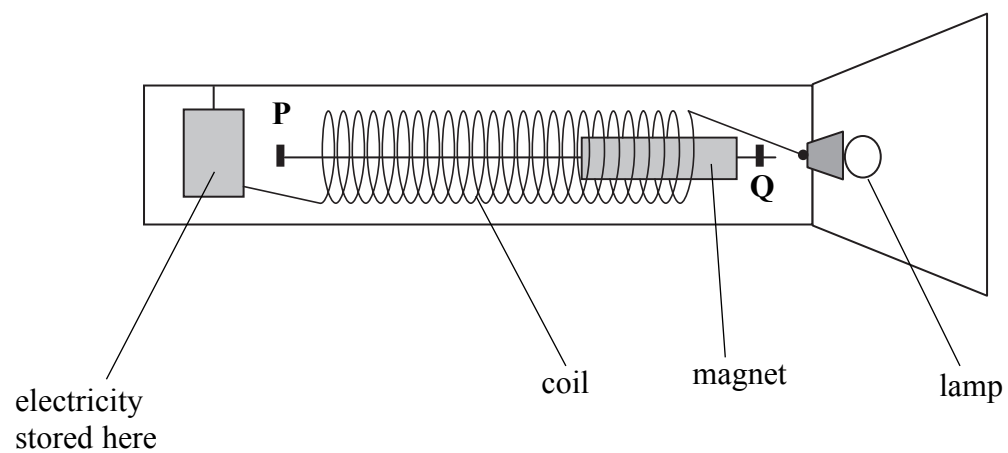
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Questions 1 to 16 must be answered by Foundation tier candidates only.
Higher tier candidates start at question 17.

John's torch

John's torch contains a magnet which slides from **P** to **Q** inside a coil.
The movement of the magnet produces electricity.

To make it work, the torch has to be shaken.
This induces a voltage across the coil.

1.   The coil is made from

    A   plastic
    B   glass
    C   cotton
    D   metal

2.   The size of the induced voltage across the coil depends on

    A   the temperature of the magnet
    B   the speed of the magnet
    C   the colour of the magnet
    D   the amount of current in the magnet
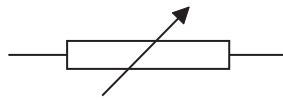
3.   The torch does **not** need a fuse because

    A   the voltage is small
    B   the lamp produces light
    C   the torch has a switch
    D   the torch is earthed

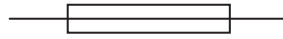**An electric motor**

The diagram shows a simple electric motor.
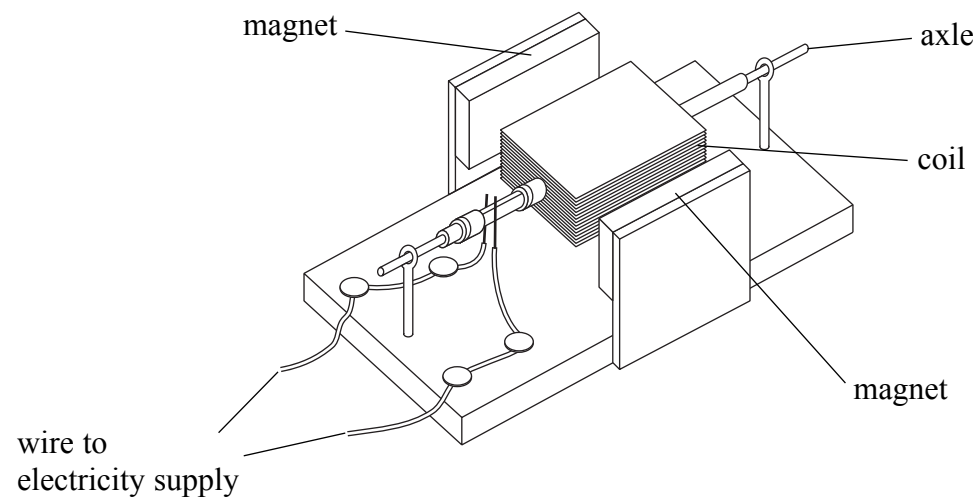
4. The speed of a motor can be controlled by a variable resistor.
Which of these shows the symbol for a variable resistor?

A   **B**

C   **D**

5. The current in the wires of the coil is a flow of

    A   copper atoms
    B   copper ions
    C   negative electrons
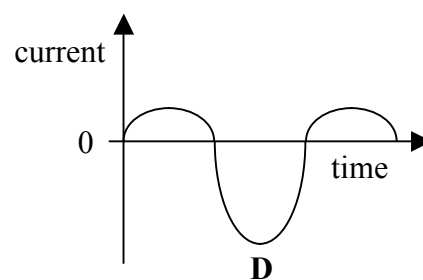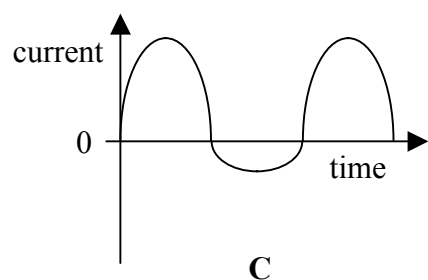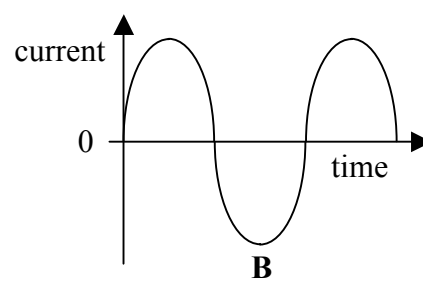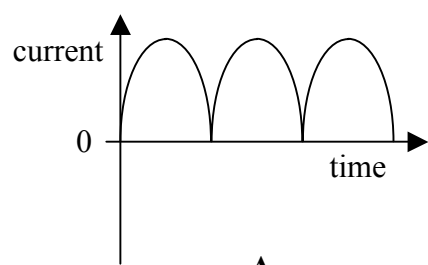   **D**   positive electrons

6. Motors like this have a low efficiency.
A low efficiency means that

    A   a lot of time is wasted
    B   a lot of energy is wasted
    C   a lot of current is wasted
    D   a lot of resistance is wasted

7. The motor is **designed** to transfer electrical energy into

    A   chemical energy
    B   light energy
    C   kinetic energy
    D   wind energy

8. Which of these is a direct current?

9. Which of these is a **source** of direct current?

    A   an ammeter
    B   a solar cell
    C   a fixed resistor
    D   an energy-saving lamp

Interschool quiz

Alex makes up some questions for the science section of the quiz.
Here are some of her questions for you to answer.
Please answer them.

10. Sometimes a person is better than a computer at taking readings.
A reason for this is that

    A   a person can take readings more quickly
    B   a person can repeat readings more often
    C   a person can take readings in more places
    D   a person can decide how many readings to take

11. The shutter of a digital camera is kept open for different times.
The length of time depends on the brightness.
Which of these controls how long the shutter is kept open?

A   a thermistor
B   a dynamo
C   a light-dependent resistor
D   a stopwatch

12. Which of the following have only been possible for about a hundred years?

A   measuring temperature
B   measuring pulse rate
C   X-raying broken bones
D   pulling out bad teeth

13. The rate of transfer of electrical energy is the same as

A   resistance
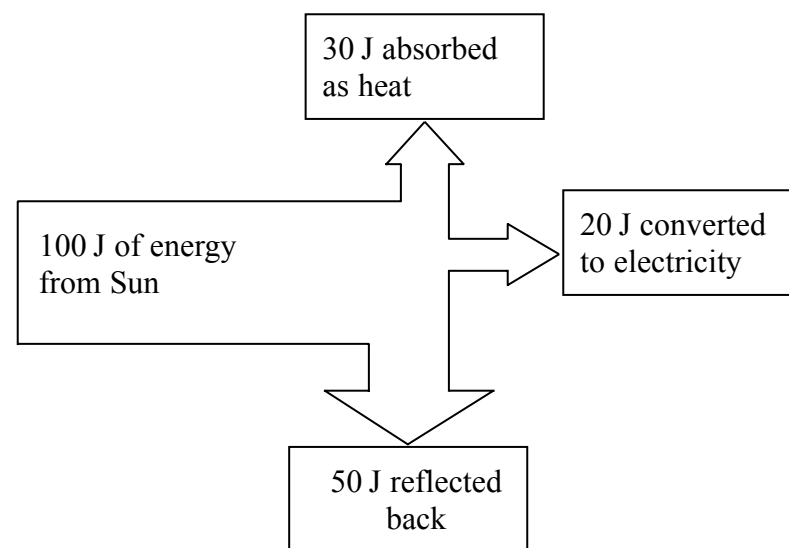**B**   current
C   voltage
D   power

Solar power

14.

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

Ian uses a solar cell to charge his batteries.
The diagram shows what happens to the energy from the Sun after it strikes the solar cell.

The efficiency of the solar cell is

A   20%
B   30%
C   50%
D   100%

Use this information to answer questions 15 and 16.

Harmful gases are produced when fossil fuels are burnt.
Using one system of solar cells instead will reduce the amount of harmful gases by 1200 kg each year.
During the lifetime of this system this adds up to about 30 000 kg.

15.   The lifetime of this system is about

A   0.04 years
B   25 years
C   31 200 years
D   36 000 000 years

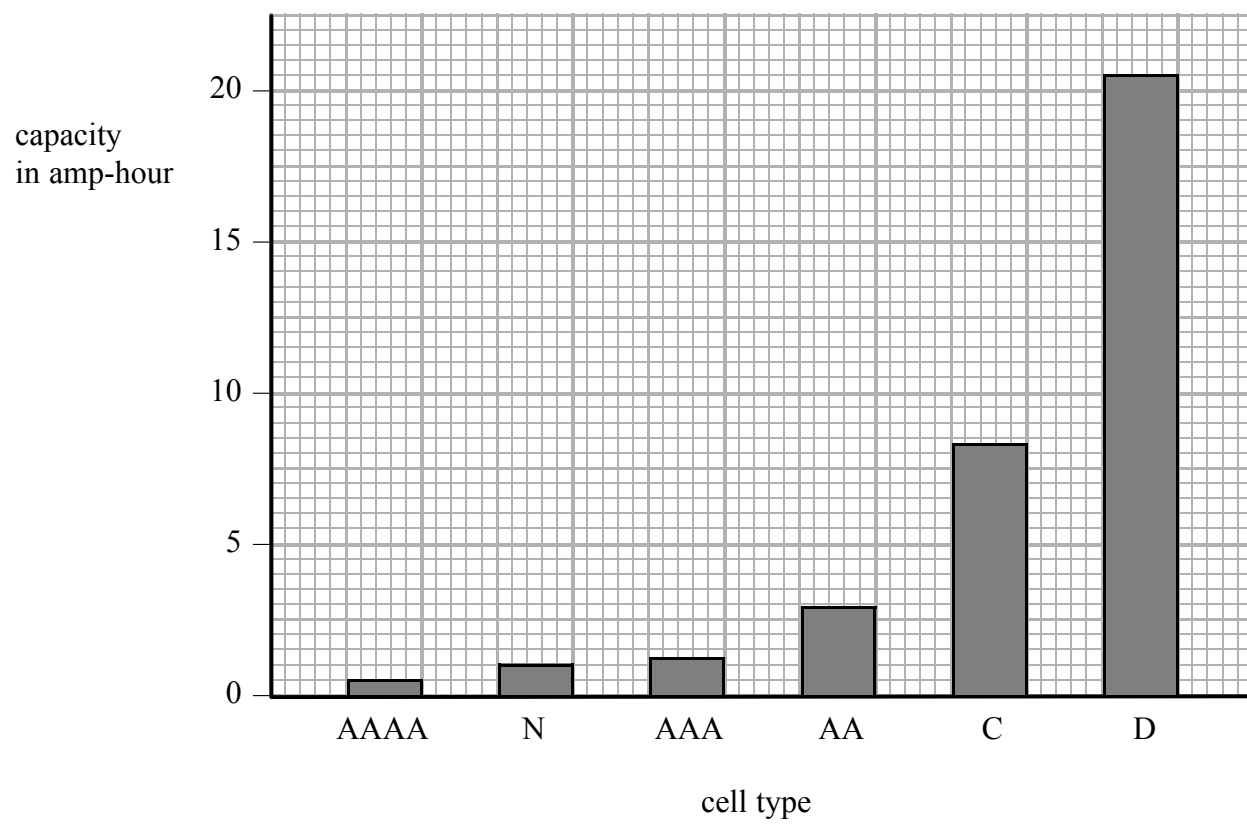**16.**   Which of these is **produced** when fossil fuels burn?

A   carbon dioxide
B   nitrogen
C   oxygen
D   natural gas

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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.**

Capacity of cells

The bar chart below shows several types of cell and the capacity of each.

17. The capacity of a type C cell is

    A   0.5 amp-hour
    B   1.3 amp-hour
    C   2.9 amp-hour
    D   8.3 amp-hour

18. A bar chart is the best way of displaying this data about cell type.
This is because the data is

    A   reliable
    B   not reliable
   **C**   continuous
    D   discontinuous

The graph below shows the capacities and masses of the first five types of cell shown in the opposite chart.
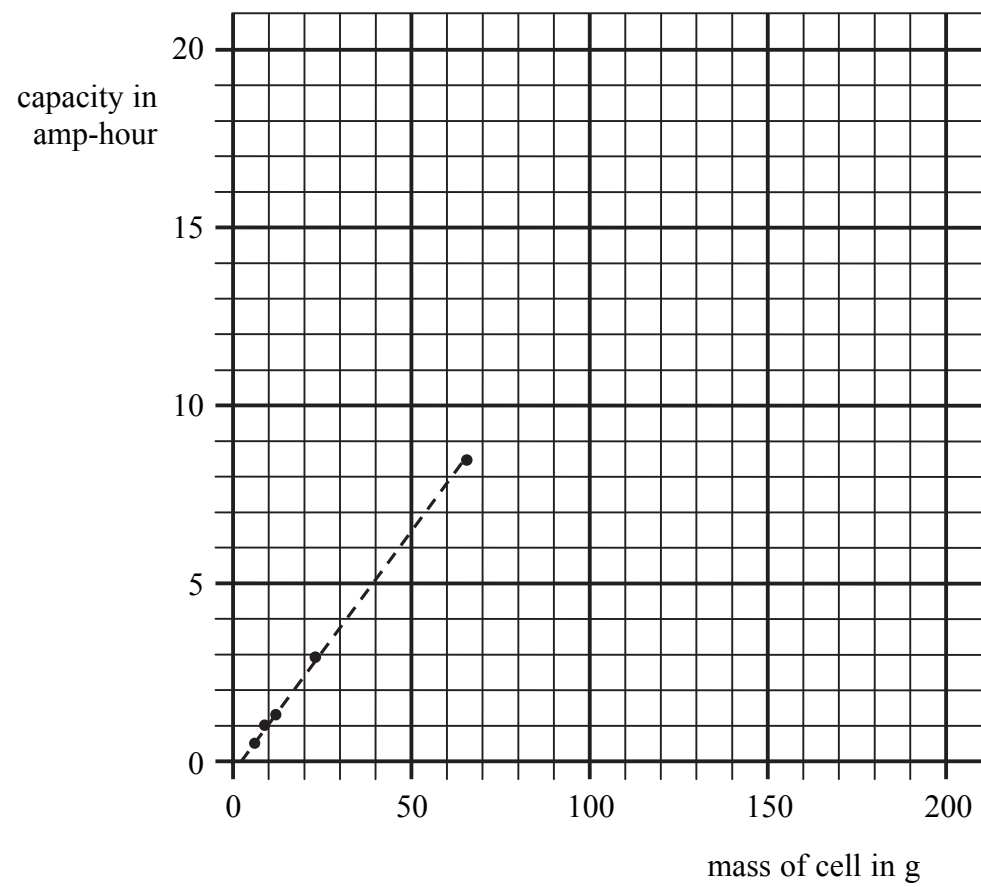
19.   The mass of a type D cell is probably about

    A   115 g
    B   130 g
    C   155 g
    D   180 g

20.   Ian noticed that the line of best fit did not pass through the origin of the graph.
       A reason for this could be that

    A   the casing of each cell has a small mass
    B   the capacity of each cell depends on its height
    C   the chemicals in each cell stop reacting
    D   the lifetime of each cell is the same

Anne's kettle

Anne investigates how long it takes her kettle to boil different amounts of cold water.
She displayed her results on her computer.

time taken to boil the water in s

number of cupfuls of water
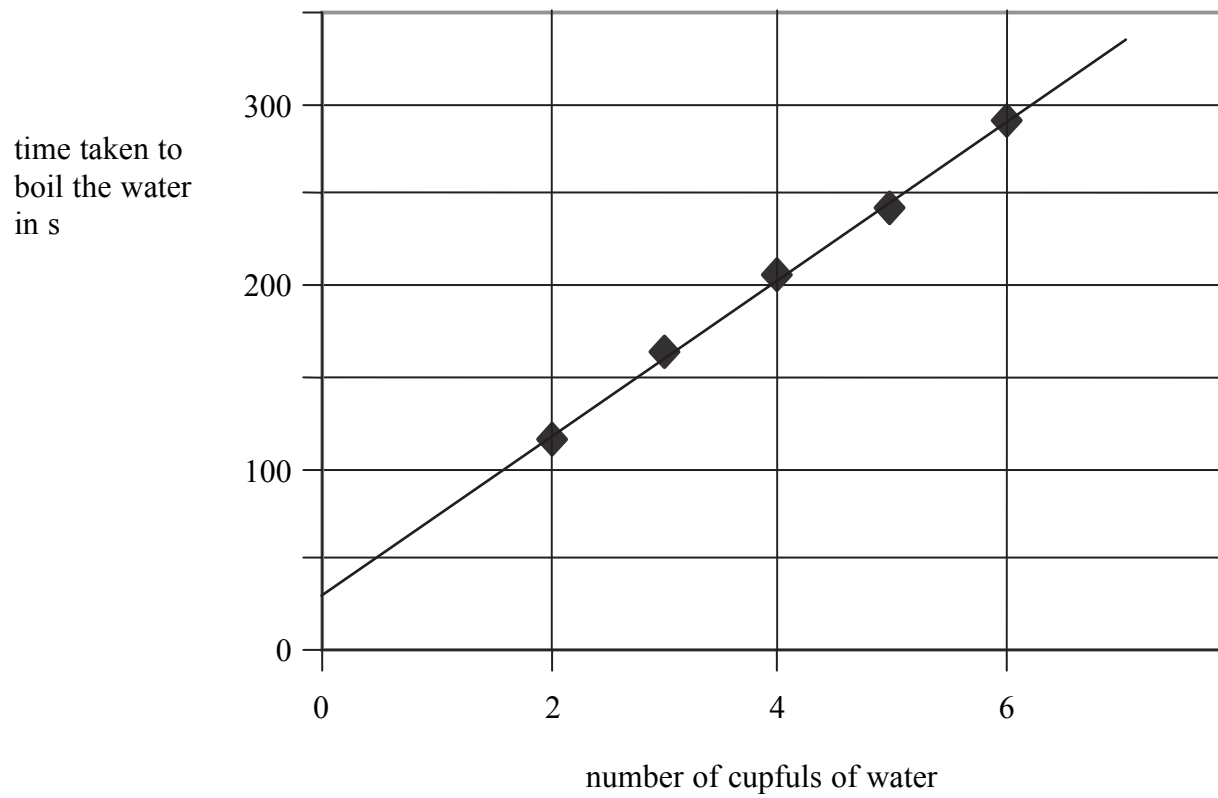
21. The time it would take to boil 3½ cupfuls of water in Anne's kettle would be about

A	150 s
B	175 s
C	225 s
D	250 s

22.

> power = current × voltage

The 230 V mains produces a current of 10 A in Anne's kettle.
What is the power of her kettle?

A	23 W
B	23 kW
C	2300 W
D	2300 kW

23.

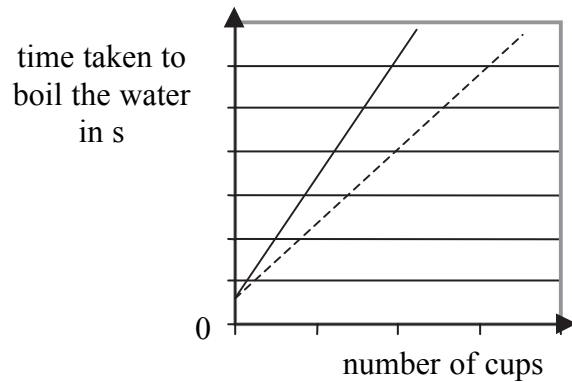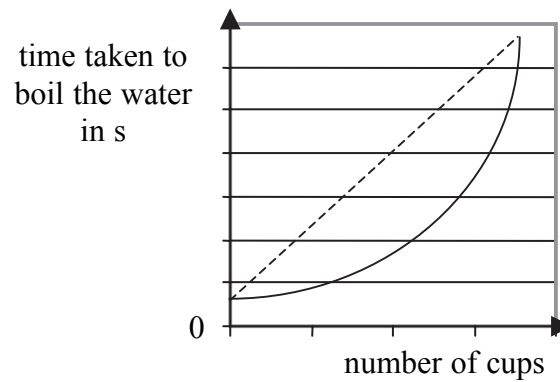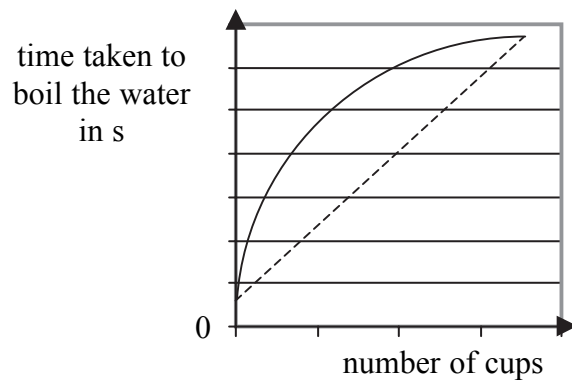$$\text{cost} = \text{power} \times \text{time} \times \text{cost of 1 kWh}$$

The price of electricity is 20p per kWh.
A 3 kW kettle is on for 15 minutes during a day.
How much does this cost?

A   £0.15
B   £0.40
C   £2.25
D   £9.00

24.   Anne put a towel around the kettle and repeated her experiment.
The dotted lines show Anne's original graph for comparison.

Which of these graphs would show her results with the towel?

A   **B**

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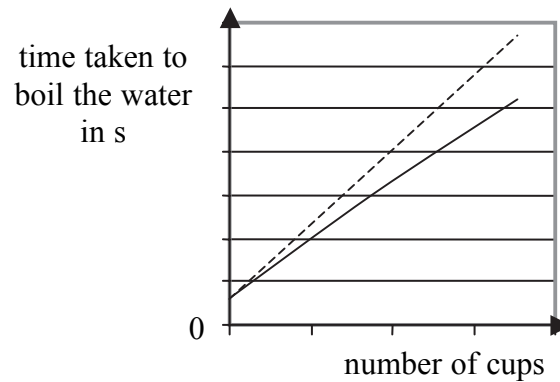
TOTAL FOR FOUNDATION TIER PAPER: 24 MARKS

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.
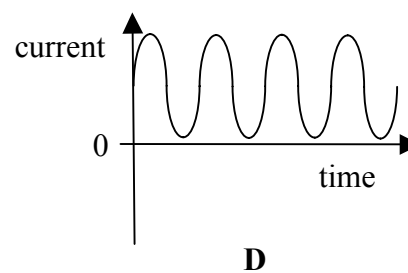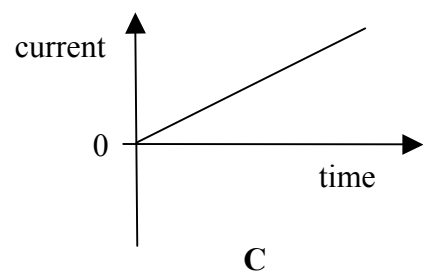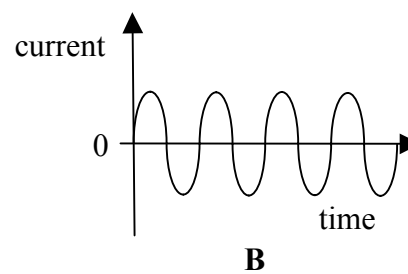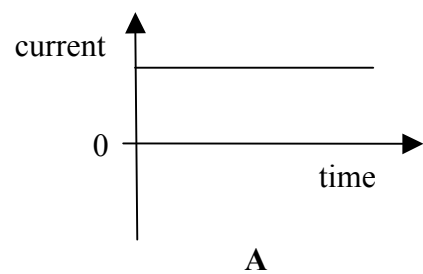
Superconductivity

An application of superconductivity is the Josephson junction.
This is made of an insulator in between two superconductors.

P $\sim\!\!\!\sim$ ▭▮▭ $\sim\!\!\!\sim$ Q

superconductor   insulator   superconductor
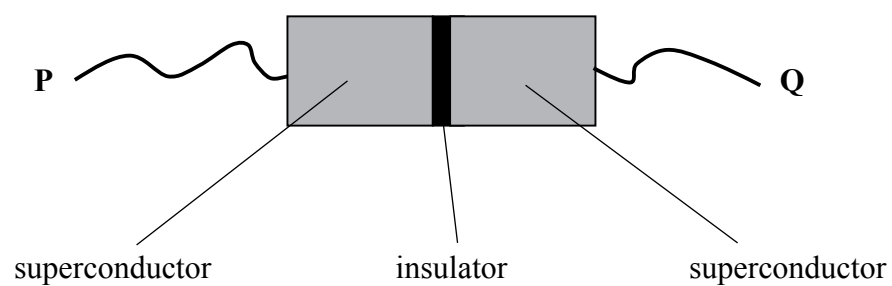
One source on the Internet states that

- When a d.c. voltage is applied between **P** and **Q**, there is an alternating current between **P** and **Q**.
- The frequency of the current is directly proportional to the d.c. voltage.

25.   Which of these shows the current between **P** and **Q**?

current

0 _____
          time

A

current

0 ∿∿∿∿
          time

B

current

0 ╱
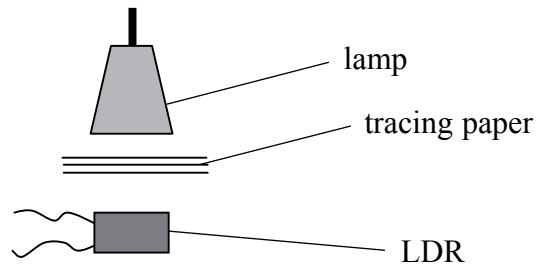   time

C

current

0 ∩∩∩∩
          time

D

**26.** Which line on the graph shows how the frequency of the current is related to the d.c. voltage for a Josephson junction?
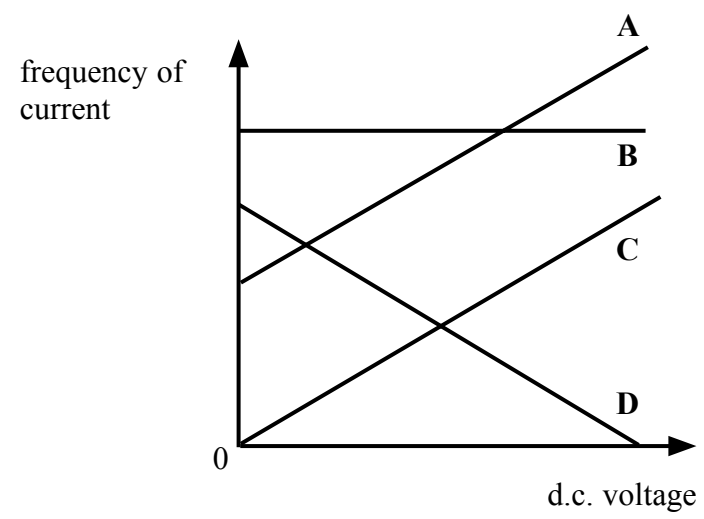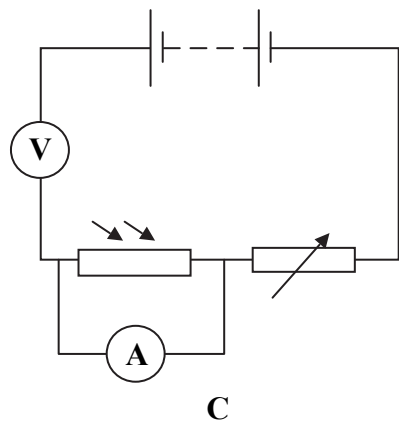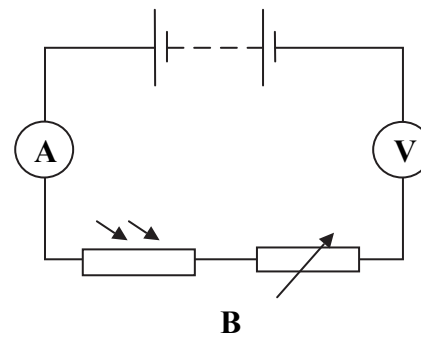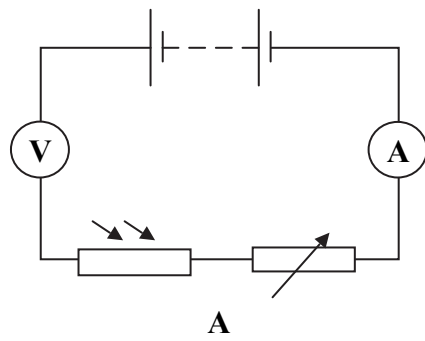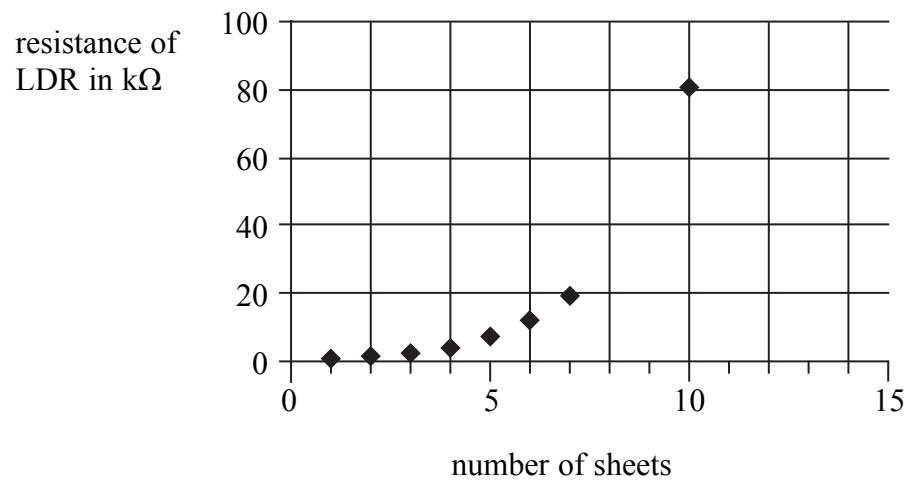
Investigating light-dependent resistors (LDRs)

Peter and his group investigate a light-dependent resistor.
They use different numbers of sheets of tracing paper between a lamp and the LDR.

27. Which of these shows the circuit they should use to measure the resistance of the LDR?
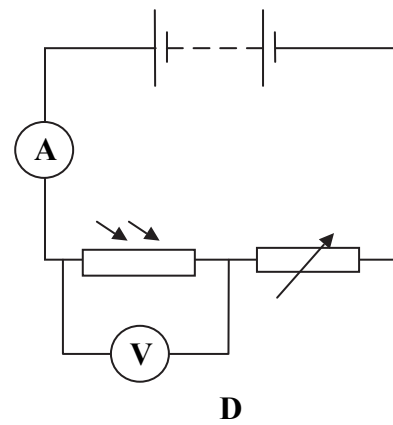
Peter plotted the results on the grid below.

28. Peter estimated the value of resistance for 9 sheets of paper to be 52 kΩ.
His friends comment on his results.

Peter's estimate would have been more **valid** if he had drawn a straight line of best fit.

Anne

Peter's value would have been more **reliable** if he had used a straight line to join the points for 7 and 10 sheets.

Bart

Peter could make a more **valid** estimate for 9 sheets if he had found the value of resistance for 8 sheets.

Carl

Peter's value would have been more **reliable** if he had quoted it to more places of decimal.

Dawn

Who is correct?

A   Anne
B   Bart
C   Carl
D   Dawn

29. $V = I \times R$

The voltage across the LDR is 12 V.
When Peter used 10 sheets of paper, the current in the LDR was about

A   0.15 mA
B   0.67 mA
C   0.15 A
D   0.67 A

Electricity at home

30. Paul wants to install a wind-powered generator on his house but his neighbours are objecting. A good reason for objecting is that the wind-powered generator might

   A   generate alternating current
   B   cause a strong magnetic field
   C   produce noise pollution
   D   only work when the wind blows

31. The graph shows how output current and output voltage vary for different intensities of light (25 W/cm^2 to 100 W/cm^2) on a solar panel.
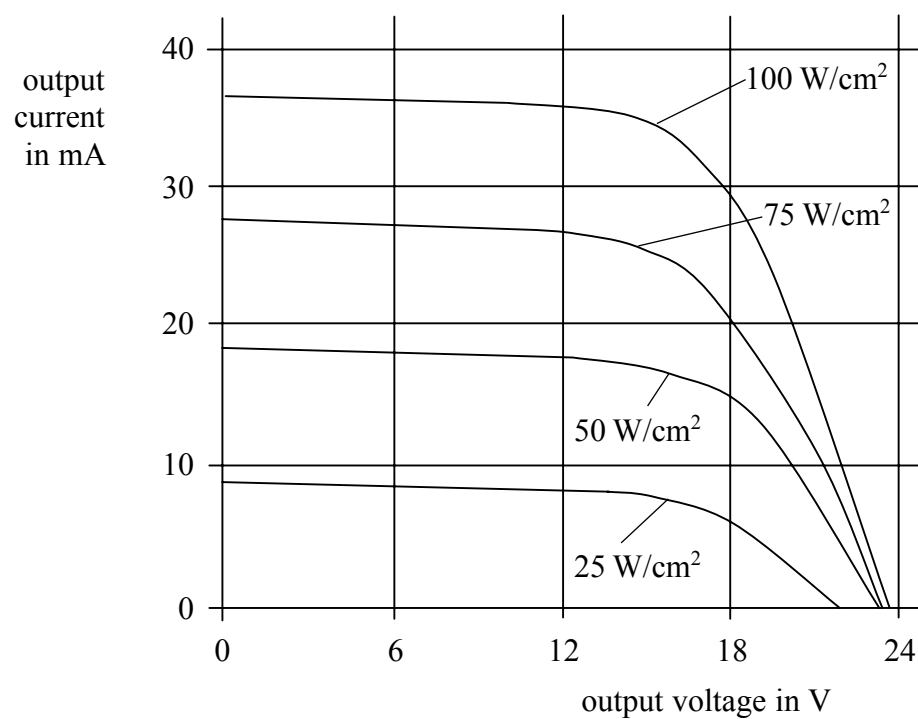
Which of these statements is correct for the graph?

   A   The output current is directly proportional to the output voltage
   B   The output voltage is nearly proportional to light intensity
   C   For 50 W/cm^2, the output voltage increases as the output current increases
   D   At 6 V, the output current is nearly proportional to the light intensity

32. Anne drills a hole in a wall.
She should connect her power drill to the mains through a residual current circuit breaker (RCCB).
An RCCB is designed to

   A   act slowly to let the fuse 'blow'
   B   act quickly when there is an electrical fault
   C   allow the drill to turn slowly for more power
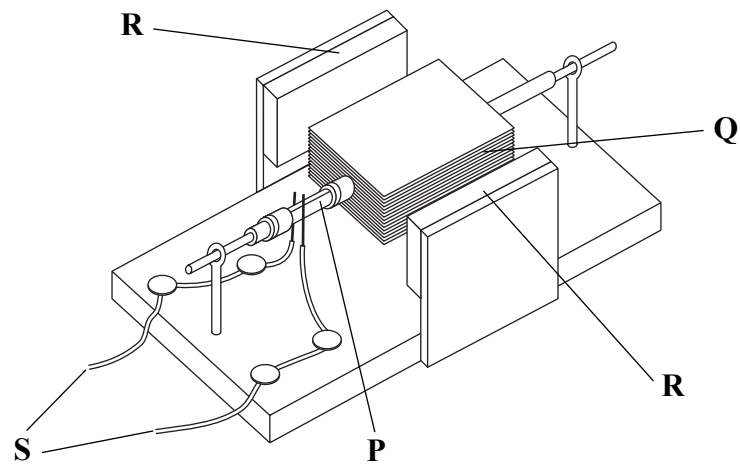   D   be replaced each time it breaks the circuit

33.

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

The electric motor in Anne's drill has an efficiency of 40%.
The drill provides 1000 J of useful energy.

The total energy supplied to the drill is

A   25 J
B   400 J
C   2500 J
D   40 000 J

34. The diagram shows a simple electric motor.

Which two parts provide the turning forces in the motor?

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

35. Which row of the table correctly compares a fuse and an RCCB?

	a fuse is designed to protect	an RCCB works by comparing
A	a person	currents
B	the appliance	voltages
C	a person	voltages
D	the appliance	currents

36. The diagram shows a circuit containing three identical lamps and four identical fuses.
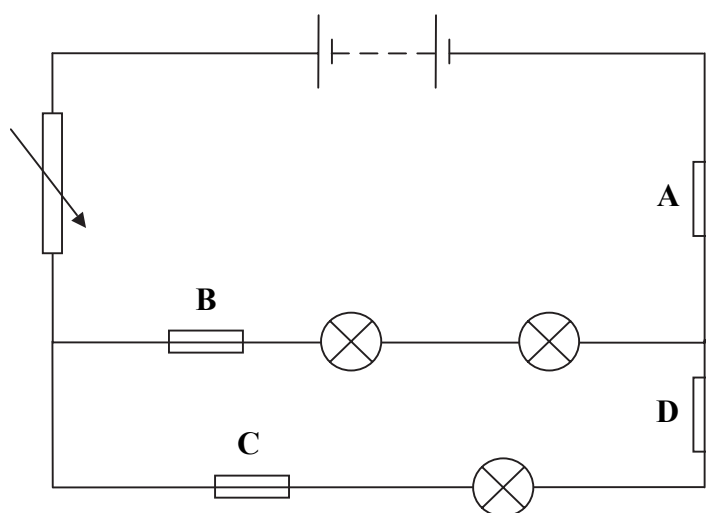
The resistance of the variable resistor is gradually reduced until one of the fuses 'blows'.
Which fuse is likely to 'blow' first?

37.

power = current × voltage

A night light for a child's room works from the 230 V mains with a power of 2 W.
The arrangement has a built-in fuse.
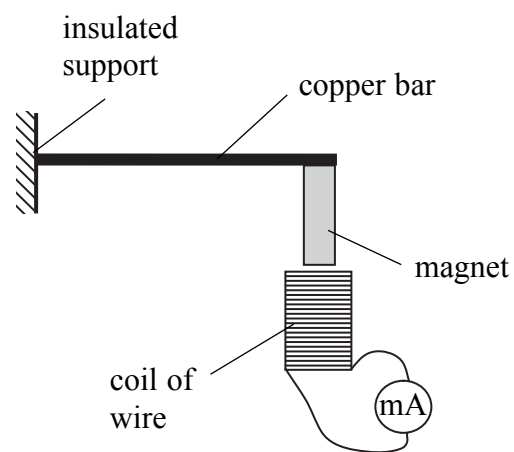The value of the fuse should be

A   50 mA
B   800 mA
C   13 A
D   115 A

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An atomic battery

The diagram shows an arrangement which produces electricity in the coil.

- A copper bar is fixed to an insulated support at one end
- A magnet hangs from the other end

insulated
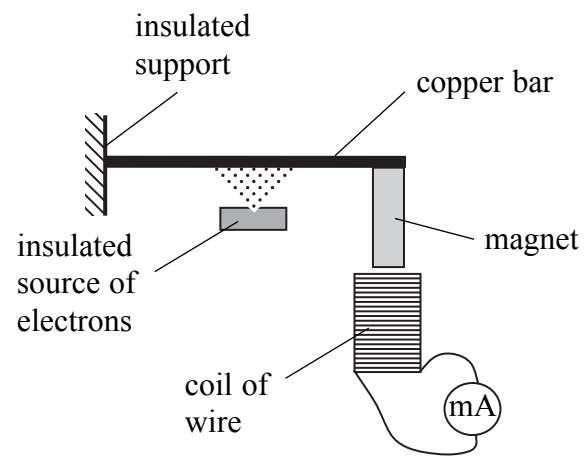support

copper bar

magnet

coil of
wire

(mA)

- Electrons from an insulated source strike the copper bar
- The copper bar becomes charged
- The copper bar is attracted towards the source and bends.

insulated
source of
electrons

(mA)
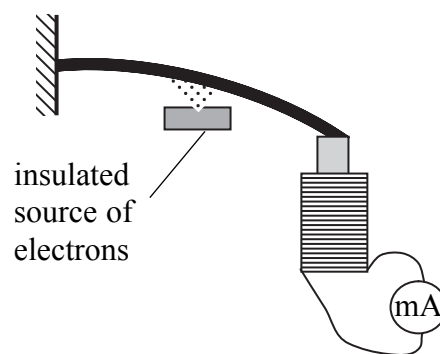
- The magnet moves downwards into the coil.
- Eventually the bar touches the source and discharges.

(mA)
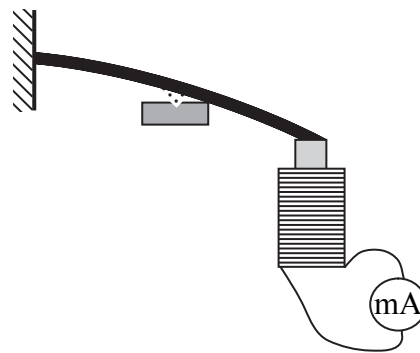
- The bar springs back straight again, pulling the magnet out of the coil.

38. The energy changed to electrical energy comes from the

    A   insulated support
    B   wire in the coil
    C   bending of the bar
    D   source of electrons

39. The movement of electrons across the space between source and copper bar forms an electric current.

John and Anne discuss these electrons.

> The electrons have a negative charge.

John

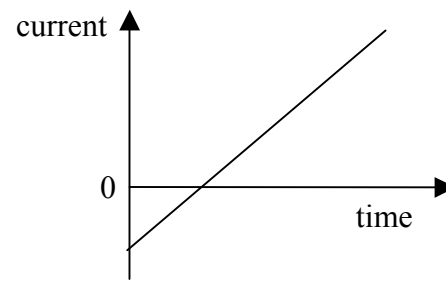> The source of electrons is positively charged after the electrons leave it.

Anne

Who is correct?

A   John only
B   Anne only
C   both John and Anne
D   neither

40. The charge on the bar increases steadily.
The bar slowly bends until it touches the source.
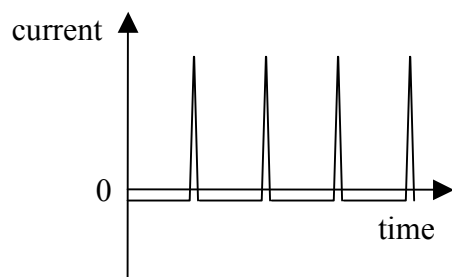Then it springs back quickly to become straight.

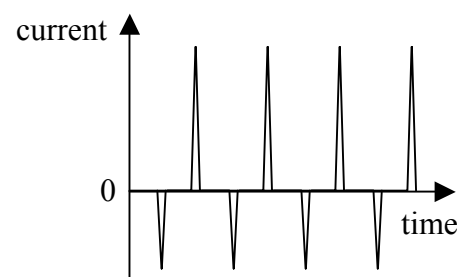Which of these graphs **best** predicts the current in the meter?
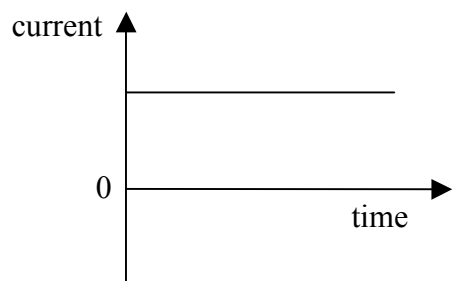
A

B

C

D

TOTAL FOR HIGHER TIER PAPER: 24 MARKS

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