

Surname	Initial(s)
Signature	

Paper Reference(s)

5009 5045

Edexcel GCSE

Science (5009)

Physics (5045)

P1a – Topics 9 and 10

Foundation and Higher Tier

Thursday 22 November 2007 – Morning

Time: 20 minutes

Materials required for examination

Multiple Choice Answer Sheet
HB pencil, eraser and calculator

Items included with question papers

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.



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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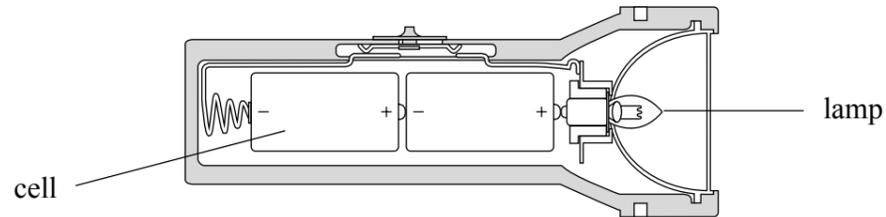
Turn over

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

Torches

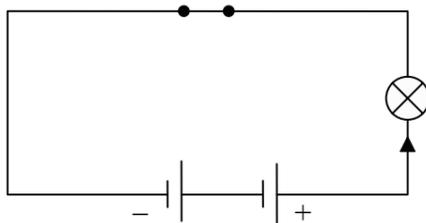
Anne has just bought a torch.



1. The current in this torch is
 - A alternating
 - B vibrating
 - C direct
 - D static

2. In Anne's torch there are two dry cells.
A **disadvantage** of this is that
 - A the cells cannot be used when it is raining
 - B the light will be too bright
 - C the lamp will receive too much power from the two cells
 - D the cells need to be replaced instead of being recharged

3. The circuit diagram of Anne's torch looks like this:



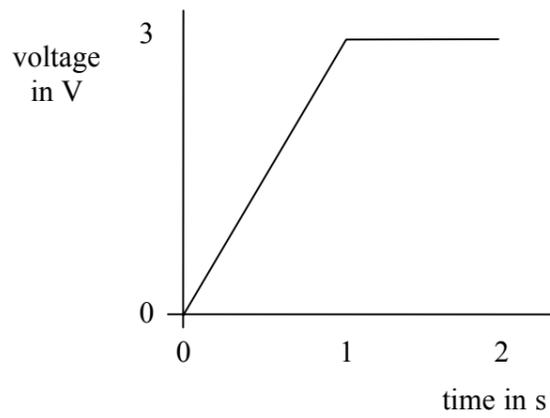
The arrow on the diagram shows the direction of current in the lamp.
Which row of the table is correct for the lamp?

	direction of electric current	direction of electron movement
A	↑	↓
B	↓	↑
C	↑	↑
D	↓	↓

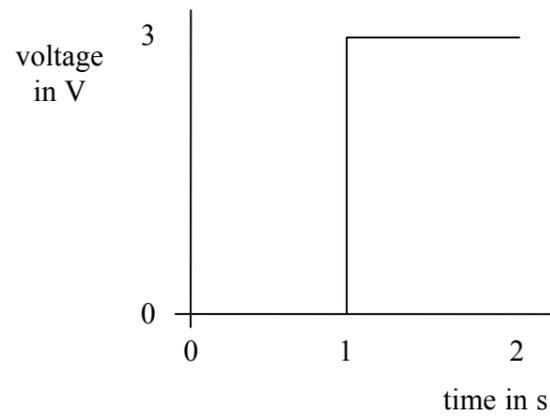
4. The lamp contains a glowing filament.
The filament gives out waste heat as well as useful light.
For this reason, all filament lamps have a low

- A power
- B current
- C voltage
- D efficiency

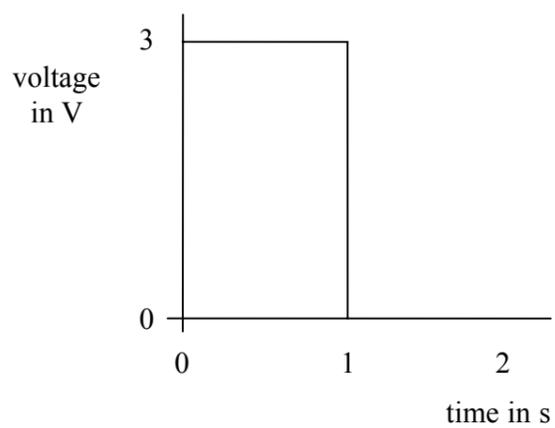
5. Anne picks up the torch and switches it on one second later.
Which graph best shows how the voltage across the lamp changes after she picks up the torch?



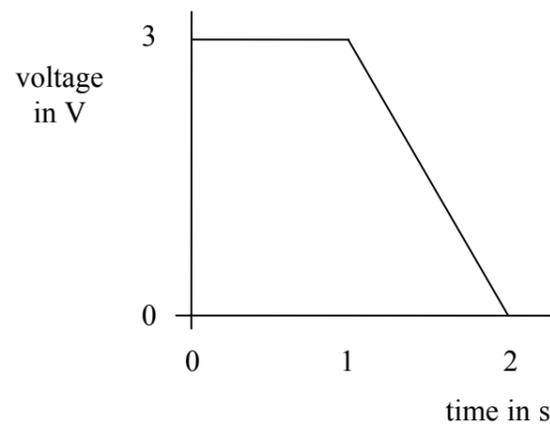
A



B



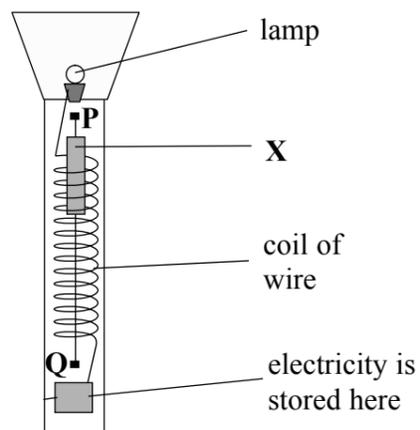
C



D

Use this information to answer questions 6, 7 and 8.

John has a torch which works without batteries.
It does not need to be connected to the mains supply either.
The diagram shows what it contains.



When John shakes the torch, part **X** moves up and down between **P** and **Q**.
The lamp then lights.

6. Part **X** is

- A** an insulator
- B** a thermistor
- C** a magnet
- D** a fuse

7. The current in the coil when the lamp lights is

- A** a flow of south poles
- B** a flow of north poles
- C** a flow of positive electrons
- D** a flow of negative electrons

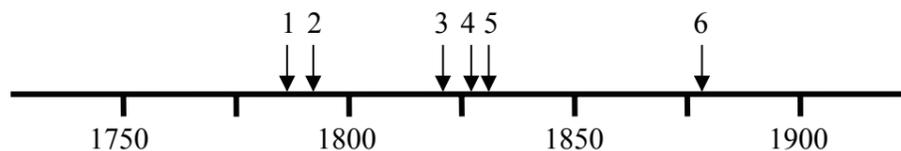
8. The power of the lamp could be

- A** 0.1 W
- B** 0.5 Ω
- C** 13 A
- D** 240 V

A brief history of electricity

Use this information to answer questions 9, 10 and 11.

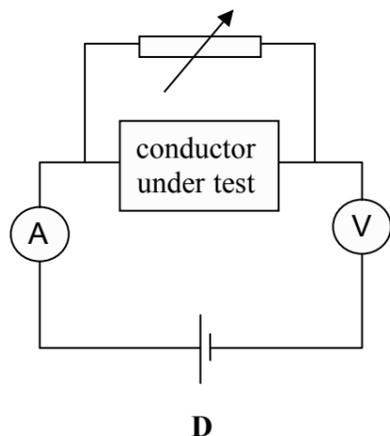
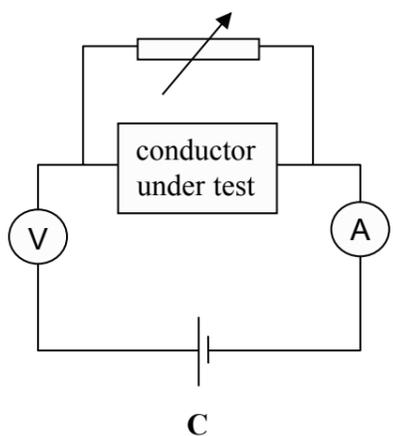
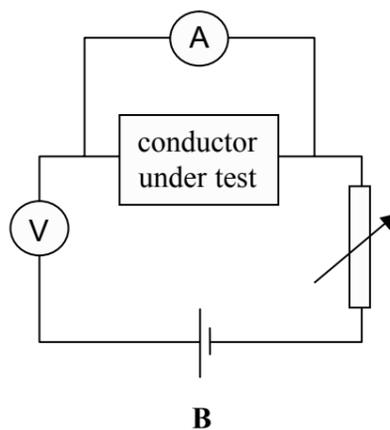
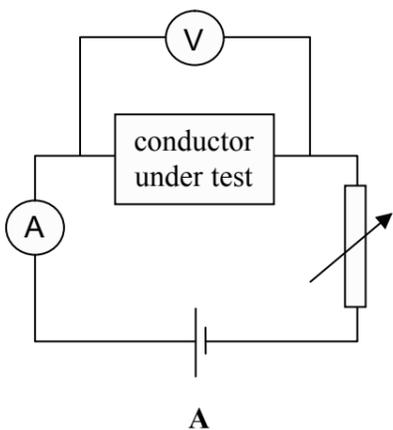
Here is a timeline for some events in the early history of electricity.



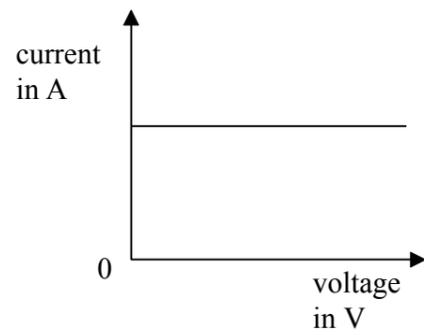
Key

- 1 Galvani thought the muscles of a frog must contain electricity
- 2 Volta made the first battery
- 3 Faraday made the first electric motor
- 4 Ohm found out how current changes with voltage
- 5 Faraday made electricity from magnetism
- 6 Swan invented the filament lamp

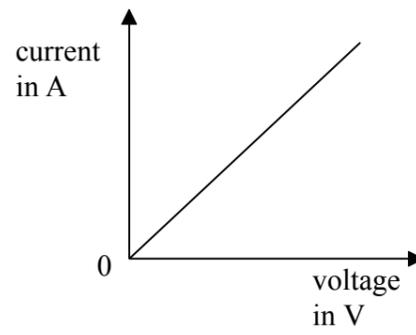
9. In 1827, Georg Ohm investigated how the current in a conductor changes with voltage. Which of these circuits would he have used?



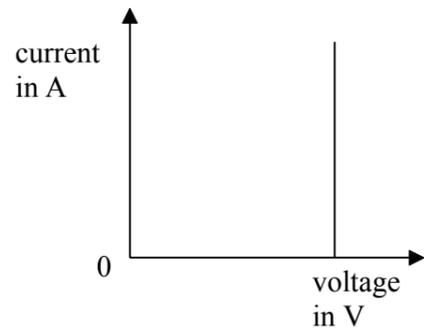
10. Ohm's conductor was a fixed resistor.
Which of these graphs shows his results?



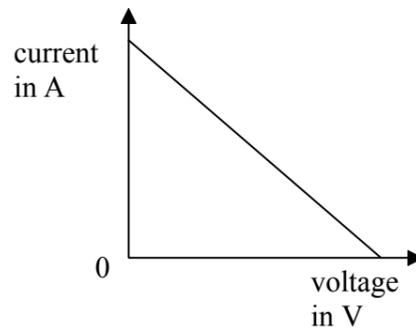
A



B

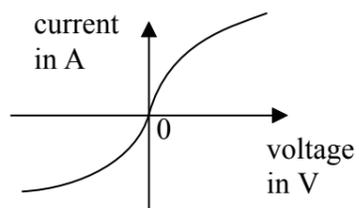


C



D

11. The graph shows how the current varies with voltage across a filament lamp.



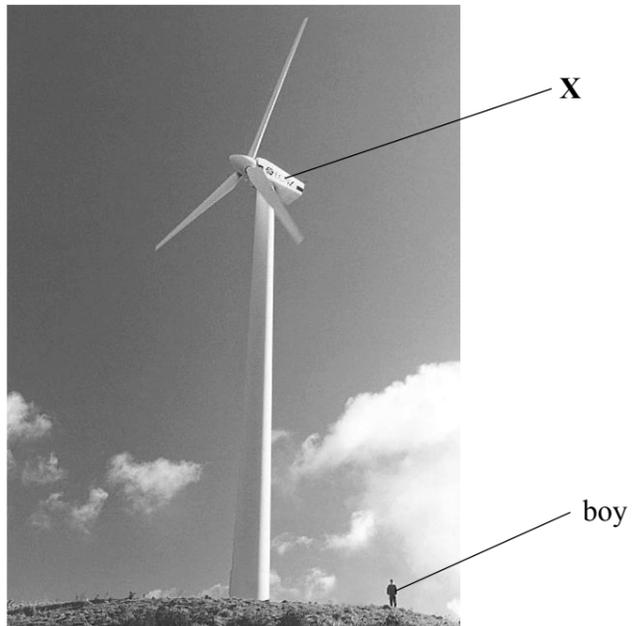
Why could Ohm not have produced a graph like this?

- A** The graph is not straight
- B** Swan had not made his invention
- C** Ohm would not have known about the results of Volta's work
- D** Faraday had not yet produced electricity from magnetism

Wind energy

Use this information to answer questions 12 to 16.

The picture shows one way of using energy from the wind.



12. The part labelled X contains the
- A generator
 - B motor
 - C solar cell
 - D battery
13. The height of the boy in the picture is 1.5 m.
The height of the tower is about
- A 5 m
 - B 25 m
 - C 75 m
 - D 100 m
14. Your value for the height of the tower is only an estimate because
- A the boy in the picture may be still growing
 - B the tower is still under construction
 - C the boy in the picture may be nearer to you than the tower is
 - D the tower is really much bigger than the picture

15. Which of these is an advantage of using energy from the wind to produce electricity?

- A There is always wind somewhere
- B The wind is a renewable energy source
- C The wind turbine produces direct current
- D Electricity from the wind costs nothing to produce

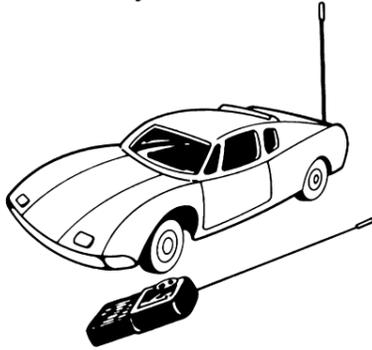
16. A wind turbine like this may have a long-term impact on the local people.
This is mainly because

- A lots of people will come to see it being built
- B lots of people will get jobs
- C it will stop people from farming
- D it will spoil people's view of the countryside

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.

Sarah's birthday presents

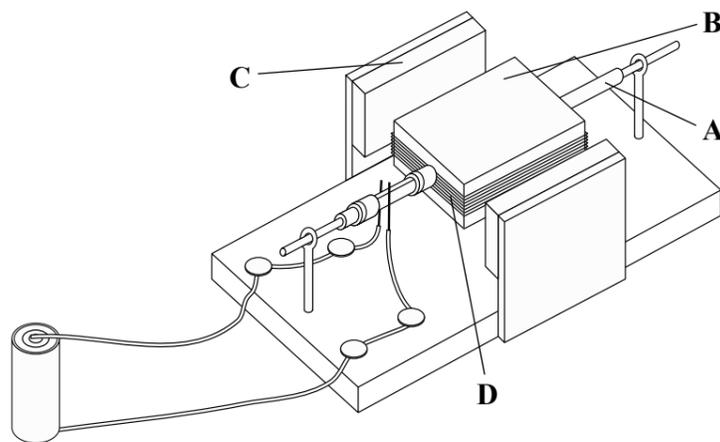
Sarah is given an electric car for her birthday.



17. The battery in the car has a capacity of 6 A h (amp-hours).
When fully charged it can supply an average current of 3 A for

- A 0.5 hour
- B 2 hours
- C 3 hours
- D 18 hours

18. The diagram shows a model of the electric motor in Sarah's car.



Which part produces a permanent magnetic field?

19. The motor in Sarah's car works because
- A it is rotated by hand
 - B there are forces on the wires in the coil when there is a current in them
 - C the permanent magnets have the same poles facing each other
 - D the axle makes the coil spin

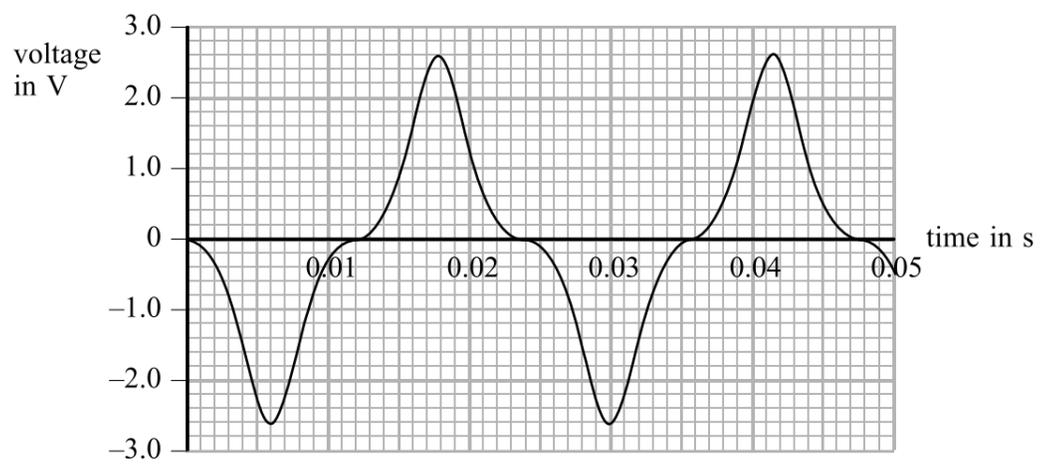
20. Which of these would make the motor in Sarah's car turn backwards?

- A swapping over the battery connections
- B using a higher current
- C using a stronger magnet
- D removing one of the magnets

Use this information to answer questions 21 to 24.

Sarah is also given a dynamo for her bicycle.

The graph shows how the output voltage of the dynamo changes with time.



21. The voltage at a time of 0.028 s is about

- A - 1.6 V
- B - 1.3 V
- C 1.3 V
- D 1.6 V

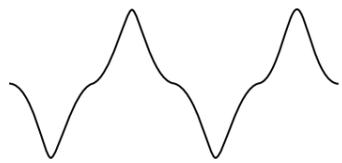
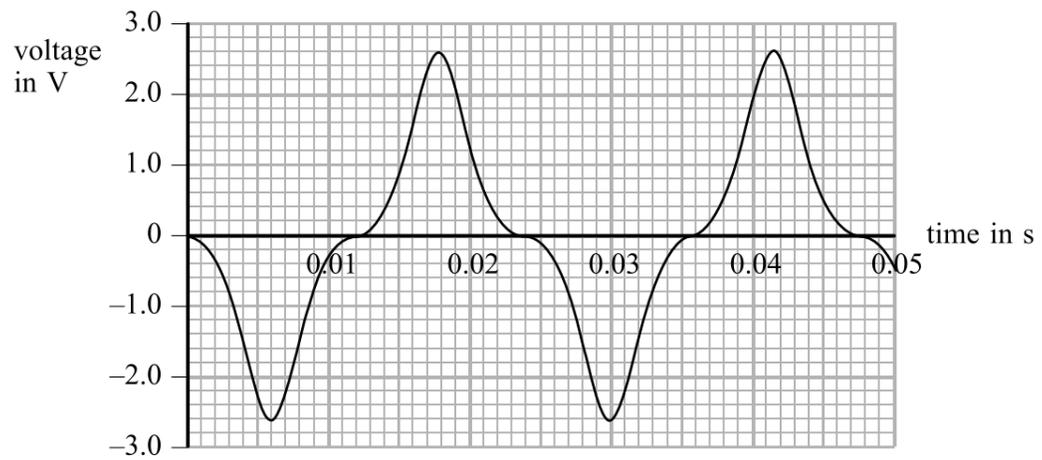
22. The type of voltage shown is alternating because

- A the voltage decreases at first
- B the greatest time shown is 0.05 s
- C the voltage goes above and below 0 V
- D the pattern repeats regularly with time

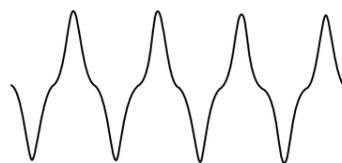
23. The dynamo does not need an earth wire for protection.
This is because the

- A voltage is low
- B the current is low
- C the resistance is low
- D the efficiency is low

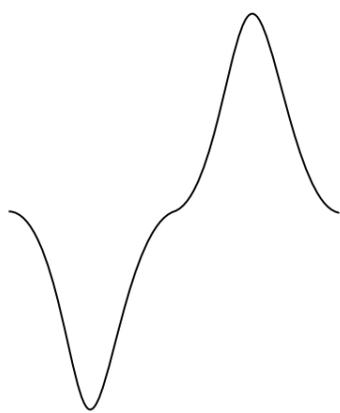
24. The original graph is shown to scale for reference.
The sketch graphs are drawn to the same scale.
Which sketch graph could show the effect of the bicycle speeding up?



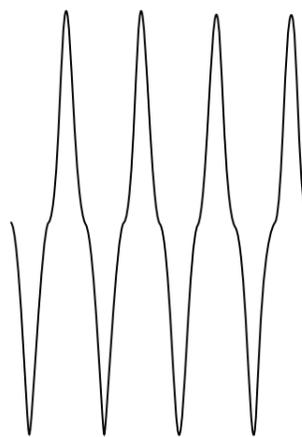
A



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.

Green power

Use this information to answer questions 25 and 26.

The photograph shows part of the power monitoring board for a combined wind generator (WG) and solar panel (PV) which charge a battery.



25.

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

The photograph shows that the power supplied to the battery is about

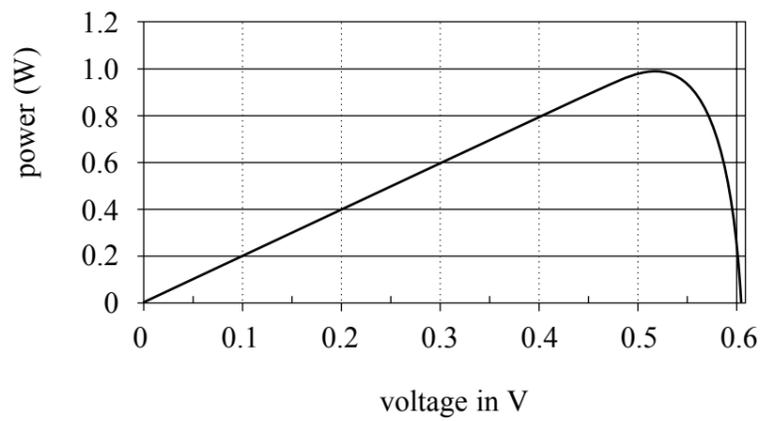
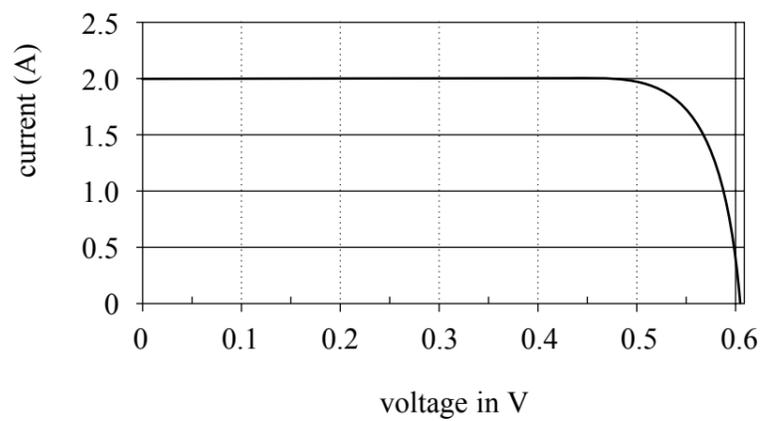
- A 6.5 W
- B 13 W
- C 26 W
- D 75 W

26. Your value for the power is only an estimate because

- A the pointers cover a whole scale division
- B the WG current is zero
- C the Sun is not shining brightly
- D the PV current is falling

Use this information to answer questions 27 and 28.

The graphs show information about one of the solar cells from the solar panel.



<http://www.pvresources.com/en/solarcells.php>

27. For this solar cell, up to a voltage of 0.45 V,

- A current is proportional to voltage
- B current is independent of voltage
- C power is independent of voltage
- D power is proportional to current

28. Paul and Jean made these statements about the graphs:

When the voltage increases up to 0.45 V, the current increases.

Paul

When the power increases up to 1.0 W, the current increases.

Jean

Who is correct?

- A Paul only
- B Jean only
- C both Paul and Jean
- D neither

Coal mine



Here is some information about the winch used at the top of a coal mine to lift a cage containing miners.

maximum weight to be lifted	23 500 N
height of winch above bottom of mine	1200 m
electric motor	37 kW 440 V 50 Hz
starting current	788 A
running current	72 A (full load)

29. Which of these statements is **incorrect**?
- A The height the cage is lifted could be 1100 m
 - B The voltage used could be 410 V
 - C The power used could be 35 kW
 - D The weight lifted could be 25 300 N

30.
$$\text{power} = \text{current} \times \text{voltage}$$

The voltage used is 440 V.
When the power in the motor is 37 kW the current is about

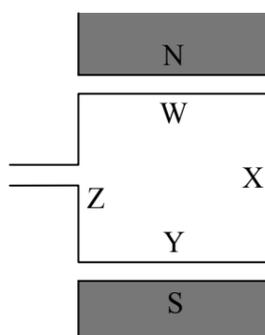
- A 0.084 A
- B 84 A
- C 16 300 A
- D 16 300 000 A

31.
$$\text{efficiency} = \frac{\text{useful output}}{\text{total input}} \times 100\%$$

The energy gained by the miners' cage is 1 350 000 J (1.35×10^6 J).
The total energy supplied for this is 3 000 000 J (3.00×10^6 J).
The efficiency of the winch is

- A 2.22%
- B 45.0%
- C 55.0%
- D 222%

32. The diagram shows one coil in an electric motor.

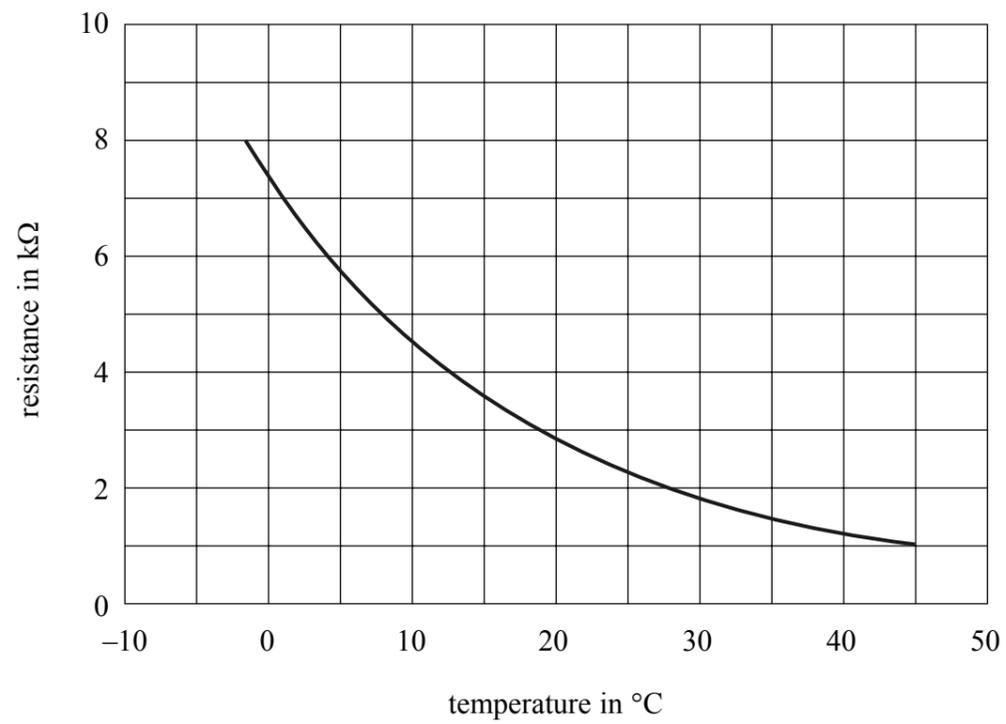


The motor rotates because

- A the force on wire X is in the opposite direction to the force on wire W
- B the force on wire X is in the same direction as the force on wire W
- C the force on wire Y is in the same direction as the force on wire W
- D the force on wire Y is in the opposite direction to the force on wire W

Faiza comes to her sensors

Faiza plans to control a lamp and a room heater automatically.
She finds this information about a thermistor.



Use this information to answer questions 33 to 36.

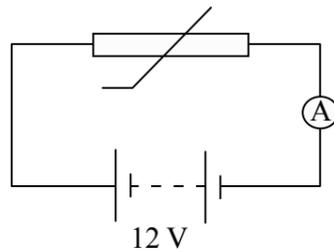
33. What temperature change corresponds to a resistance change from $7000\ \Omega$ to $2000\ \Omega$?

- A 2 °C
- B 26 °C
- C 30 °C
- D 32 °C

34.

$$V = I \times R$$

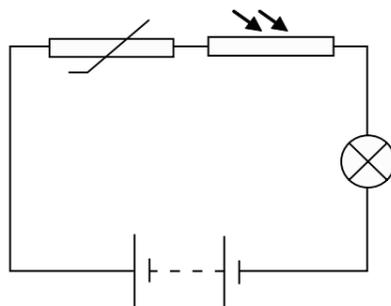
Faiza connects her thermistor to a 12 V supply and an ammeter.



When the temperature is 20 °C the current in the thermistor is about

- A 4.2 mA
- B 36 mA
- C 4.2 A
- D 36 A

35. Faiza changes the circuit to include another sensor and a lamp.



Which row of the table shows the conditions for the highest current in the lamp?

	brightness of room	temperature of room
A	dim	high
B	dim	low
C	bright	high
D	bright	low

36. The thermistor in the circuit

- A will allow the current to increase when the temperature rises
- B only works for temperatures above 0 °C
- C could lower the temperature of the room by increasing the resistance
- D has a resistance that is directly proportional to its temperature

Supercool trains

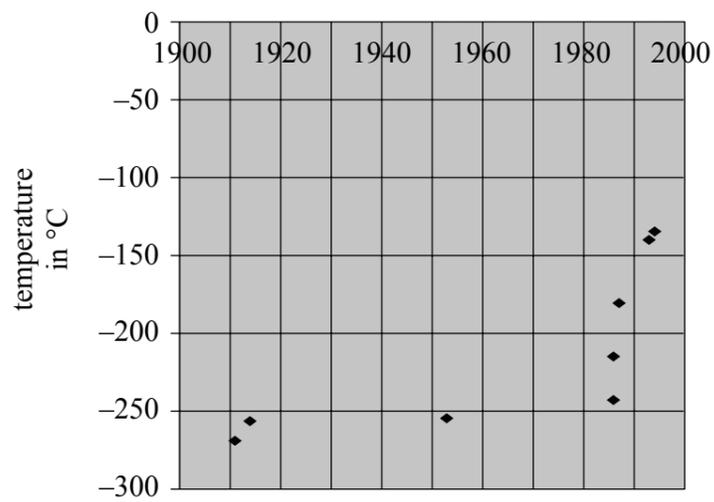
37. Maglev trains use superconductivity.
They are better than normal trains because they
- A are more efficient
 - B stop in more stations
 - C can carry fewer passengers in each carriage
 - D travel between different countries

Use this information to answer questions 38, 39 and 40.

Maglev trains use materials which become superconducting when cooled to below their 'critical temperature'.

Scientists have discovered materials with higher and higher critical temperatures.

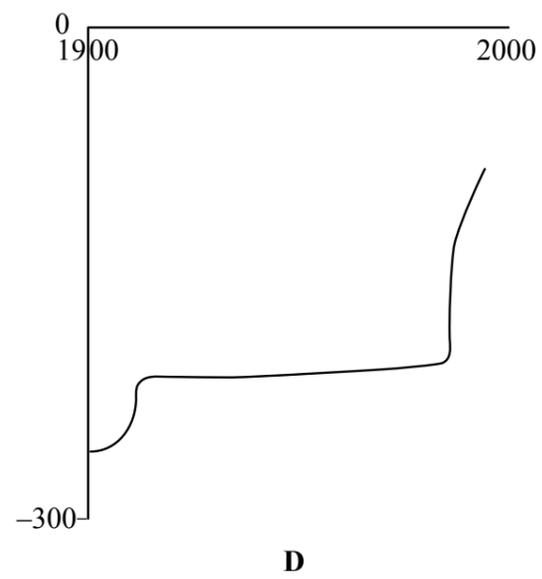
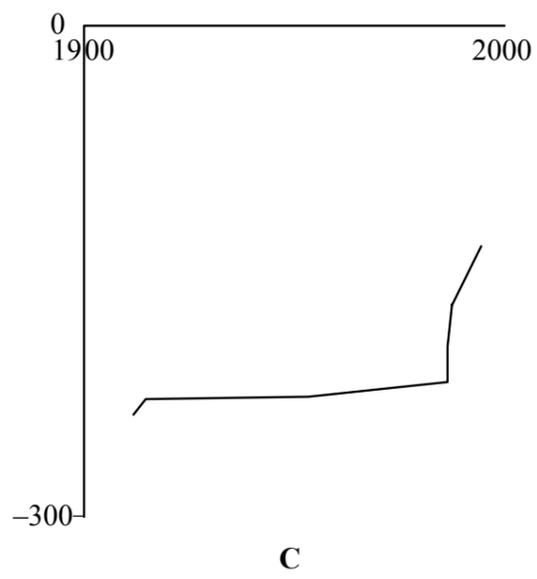
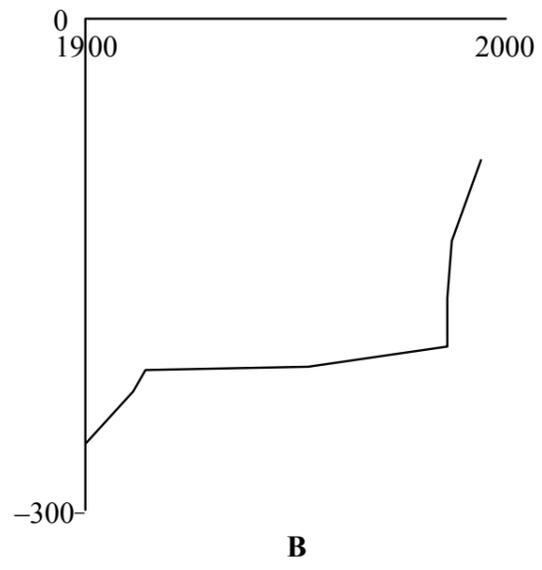
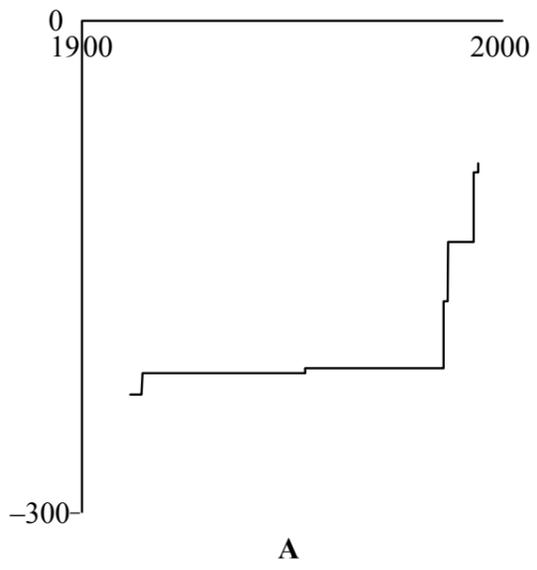
The graph and table show the dates when these discoveries were made.



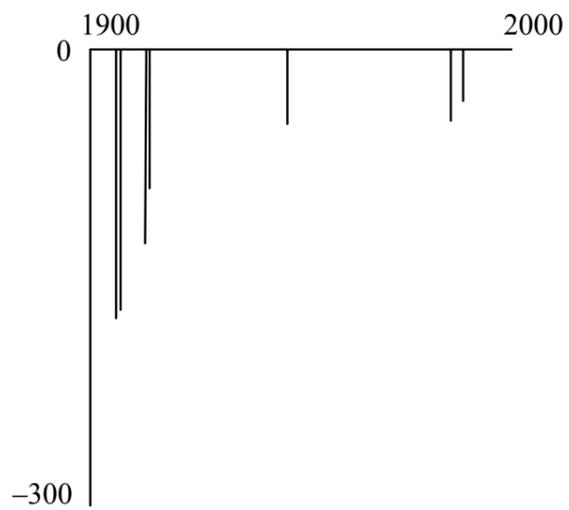
year discovered	new highest critical temperature (°C)
1911	-269
1914	-257
1953	-255
1986	-243
1986	-215
1987	-181
1993	-140
1994	-135

38. Scientists were able to make some material superconducting
- A at -240°C in 1930
 - B at -240°C in 1960
 - C at -200°C in 1986
 - D at -138°C in 2000

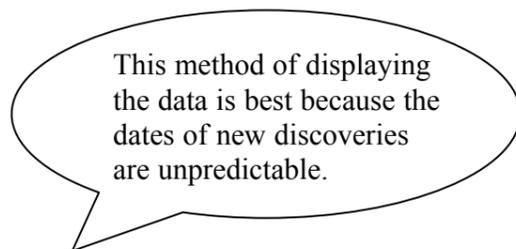
39. Which of these graphs is the best way to show the sort of data in the table?



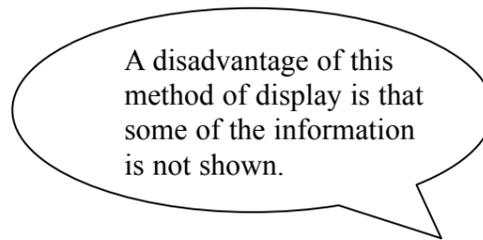
40. John's teacher asks if this would be a good way to display the data.



John and Anne discuss this.



John



Anne

Who is correct?

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

TOTAL FOR HIGHER TIER PAPER: 24 MARKS

END