

Surname	Initial(s)
Signature	

Paper Reference(s)

5009

Edexcel GCSE

Science

Physics P1a

Topic 9: Producing and Measuring
Electricity

Topic 10: You're in Charge

Foundation and Higher Tiers

Monday 25 June 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.

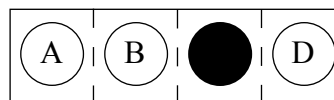
Before the test begins:

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.

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.**

Renewable energy

1. One form of renewable energy is
 - A solar
 - B coal
 - C oil
 - D natural gas

2. In a wind turbine, electricity is generated when a magnet is rotated
 - A next to a thermistor
 - B next to another magnet
 - C inside a coil of wire
 - D inside a battery

3. One advantage of solar cells over wind turbines is that solar cells
 - A supply alternating current
 - B have a low power output
 - C have fewer moving parts
 - D supply electricity continuously

4. Current is produced in
 - A a light-dependent resistor (LDR)
 - B a fixed resistor
 - C a solar cell
 - D a thermistor

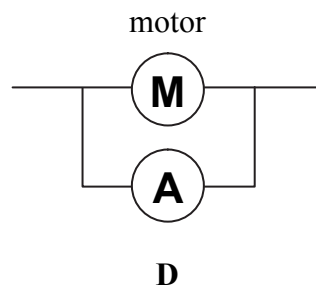
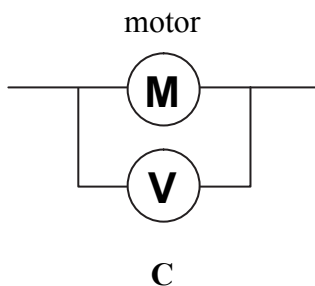
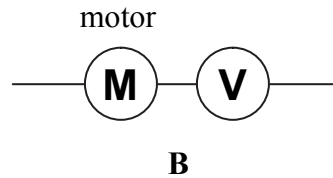
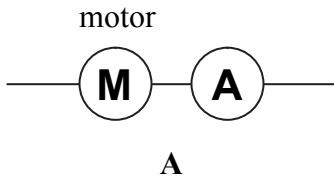
5. Ian plans to use a wind turbine to supply all the electricity to his home. A disadvantage of this plan is
 - A the wind does not blow all the time
 - B the price of fossil fuels is rising
 - C wind turbines use renewable energy
 - D wind turbines produce greenhouse gases

The battery powered birthday present

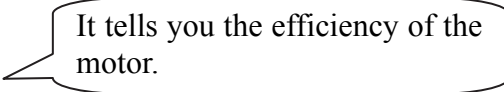
Jim received an electric motor bike for his birthday.
Jim's motor bike is battery powered.
The battery stores energy from the mains.



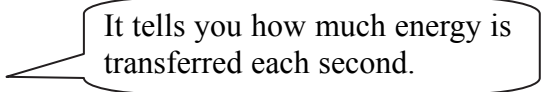
6. Jim's motor bike uses
- A an a.c. dry battery
 - B a d.c. dry battery
 - C an a.c. rechargeable battery
 - D a d.c. rechargeable battery
7. The useful energy change in the bike's motor is
- A chemical \rightarrow electrical
 - B electrical \rightarrow chemical
 - C electrical \rightarrow kinetic
 - D electrical \rightarrow thermal
8. Jim measures the current in the motor.
The arrangement he uses to do this is



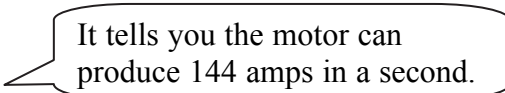
9. Jim finds that the average current in the motor is 12 amps. The fully charged battery runs out after 3 hours.
The capacity, in amp-hours (A h), of this battery is
- A 4
 - B 7.5
 - C 15
 - D 36
10. The motor has a power of 144 watts.
Some of Jim's friends try to explain what a power of 144 watts means.
Which explanation is correct?

Jon  It tells you the efficiency of the motor.

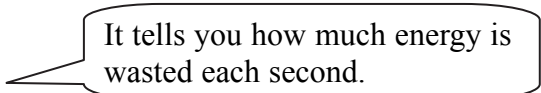
A

Hassan  It tells you how much energy is transferred each second.

B

Julie  It tells you the motor can produce 144 amps in a second.

C

Kim  It tells you how much energy is wasted each second.

D

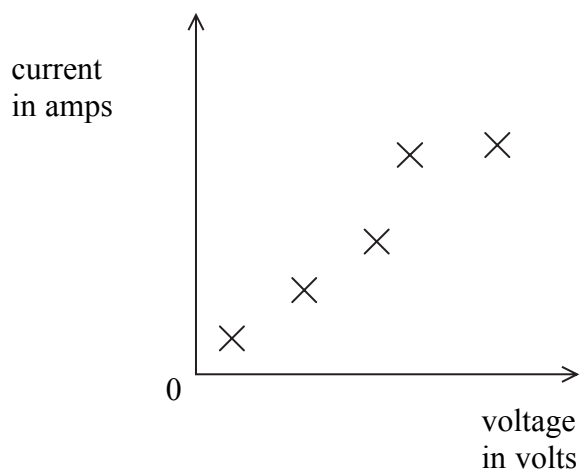
Electric current

Sally and Kate are investigating electric current during science lessons.

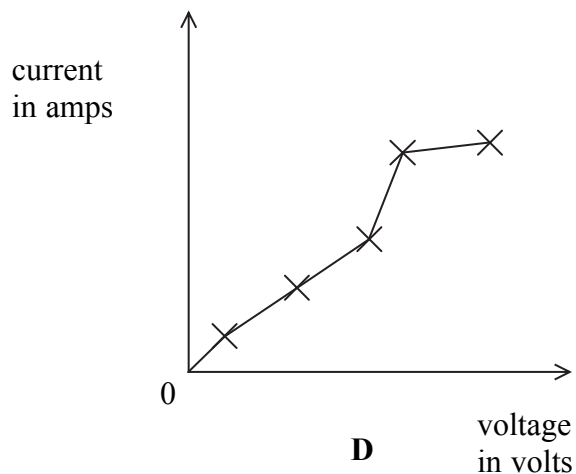
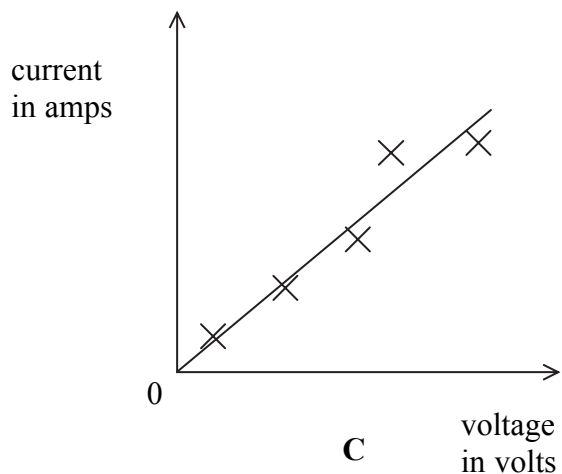
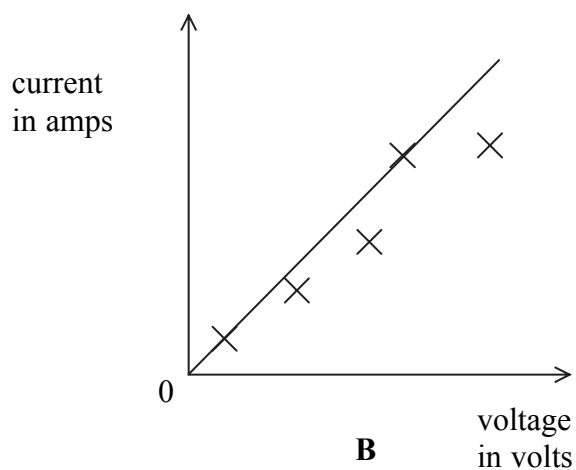
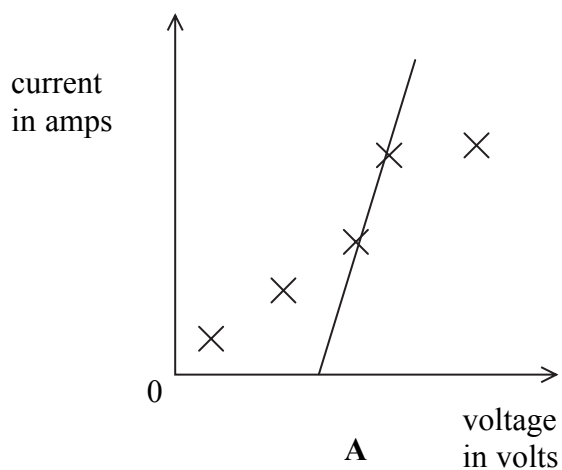
11. Kate correctly explains direct current to Sally.
A direct current in a wire is a flow of charge
- A caused by resistance
 - B in one direction only
 - C that reverses
 - D which occurs when the wire is heated
12. Sally and Kate researched sources of electric current.
Which of these is **not** used as a source of electric current?
- A solar cell
 - B torch battery
 - C bicycle dynamo
 - D light-dependent resistor (LDR)

Use this information to answer questions 13 and 14.

Sally and Kate measure the current in a wire at different voltages. Sally plots their results on a graph.



13. Which of these shows the line of best fit Sally should draw?



14. To improve the accuracy of their results, Sally and Kate should
- A repeat their measurements and calculate an average
 - B only use high voltages
 - C use alternating current instead of direct current
 - D use a computer to plot their graph
15. Sally and Kate wrote down a description of electric current.
In a wire, current is the rate of flow of negatively charged
- A atoms
 - B molecules
 - C protons
 - D electrons
16. Sally and Kate finish their investigation by explaining how important electricity has been in changing people's lives.
Which of these developments has had the biggest effect on the making of the modern world?
- A thermistors
 - B the Internet
 - C bicycle dynamos
 - D solar cells

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

Ben's fan

Ben has a small battery operated fan. He uses the fan to keep himself cool.



17. Ben wants to make the fan spin more slowly. He adds a resistor in series with the fan circuit which decreases the speed of the motor. Which of these explains why the fan spins more slowly?
- A Adding the resistor decreases the voltage across the battery
 - B Adding the resistor increases the power of the battery
 - C Adding the resistor increases the friction in the motor
 - D Adding the resistor decreases the current in the motor
18. Ben adds a circuit which will make his fan switch on when the room is warm. Which sensor would Ben use in this circuit?
- A a thermistor
 - B a filament lamp
 - C an electromagnet
 - D a light-dependent resistor (LDR)
19.

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

- The voltage across the motor is 4 V.
An ammeter shows a current of 0.2 A in the motor.
The power of the motor is
- A 0.05 W
 - B 0.8 W
 - C 8 W
 - D 20 W

Homes for the future

Selina is designing a house. She will include some energy saving features in the house.



scale model of
Selina's house

Use this information to answer questions 20, 21 and 22.

Selina wants to find out which of these will save the most money:

- double glazing
- loft insulation
- cavity wall insulation.

She makes four models of the house. They are the same except for the type of insulation.

Selina puts a 500 ml beaker of warm water into each model house.

She measures the temperatures of the water in each beaker at the start and after 20 minutes.

model house	insulation used	temperature of water (°C) at start	temperature of water (°C) after 20 minutes
1	loft	84	54
2	double glazing	89	52
3	cavity wall	88	55
4	none	89	48

20. Why does one of Selina's models have no insulation?

- A** She needs to test four houses
- B** It is used as a control
- C** It gives enough readings for a graph
- D** It gives an anomalous result

21. Which model saves the most energy?
- A model 1 with loft insulation
 - B model 2 with double glazing
 - C model 3 with cavity wall insulation
 - D model 4 with no insulation
22. Selina could improve her experiment by using
- A all three types of insulation in each model
 - B a different time for each experiment
 - C the same starting temperature for the water in each model
 - D a different volume of water in each model
23. Selina plans to use a solar heater to warm water for the radiators in the house. Which of these is an advantage of using solar heaters?
- A Solar heaters have a long payback time
 - B The amount of fuel needed to heat the house is reduced
 - C Solar heaters have a low efficiency of only about 6%
 - D A large amount of greenhouse gas is released when solar heaters are used
24. Selina will use an electric motor to pump the warm water to the radiators. In the motor, a coil is made to spin when
- A a current in the coil interacts with a current in a magnet
 - B a current in a magnet keeps changing direction
 - C a current in a magnet interacts with an electric field
 - D a current in the coil interacts with a magnetic field

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 football

There are plans to build a wind turbine to provide electricity for a Premiership football club.

- 25.** Some club members are discussing the plans.
Which of these is correct?

The wind turbine will supply
all our energy.

A

We will still need some of our
energy from the National Grid.

B

The rise in gas prices makes
wind turbines more efficient.

C

Wind turbines supply electricity more
reliably than the National Grid.

D

- 26.** The wind turbine will be on a tall tower.
For a given power output, if the wind turbine is higher up

- A** wind speed is faster and the turbine blades can be made shorter
- B** wind speed is slower and the turbine blades can be made stronger
- C** wind speed is faster and the turbine blades can be made weaker
- D** wind speed is slower and the turbine blades can be made shorter

- 27.** A wind turbine has a total input power of 2 500 kW.
The efficiency of the wind turbine is 20%.
What is the useful output power of the turbine?

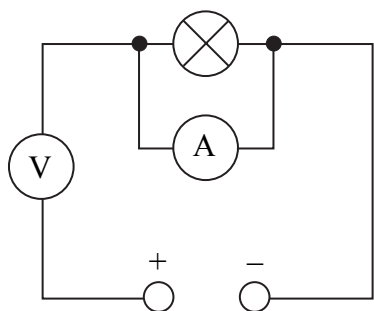
- A** 125 kW
- B** 500 kW
- C** 12 500 kW
- D** 50 000 kW

28. Increasing the turning speed of a wind turbine will increase the output voltage of its d.c. generator.
Which of these will increase the size **and also** change the direction of the induced voltage?
- A reversing the direction of the turbine blades and reversing the generator's magnetic field.
 - B using a generator coil with fewer turns and reversing the generator's magnetic field
 - C using a generator coil with fewer turns and reversing the direction of the turbine blades
 - D using a generator coil with more turns and reversing the generator's magnetic field

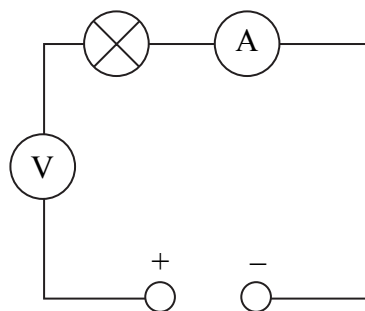
The filament lamp

Jason and Zubeda are investigating how current varies with voltage for a filament lamp.

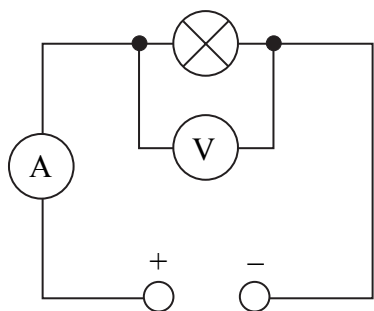
29. Which circuit should they use?



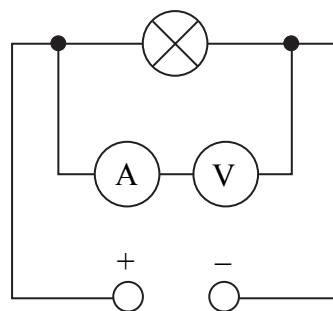
A



B



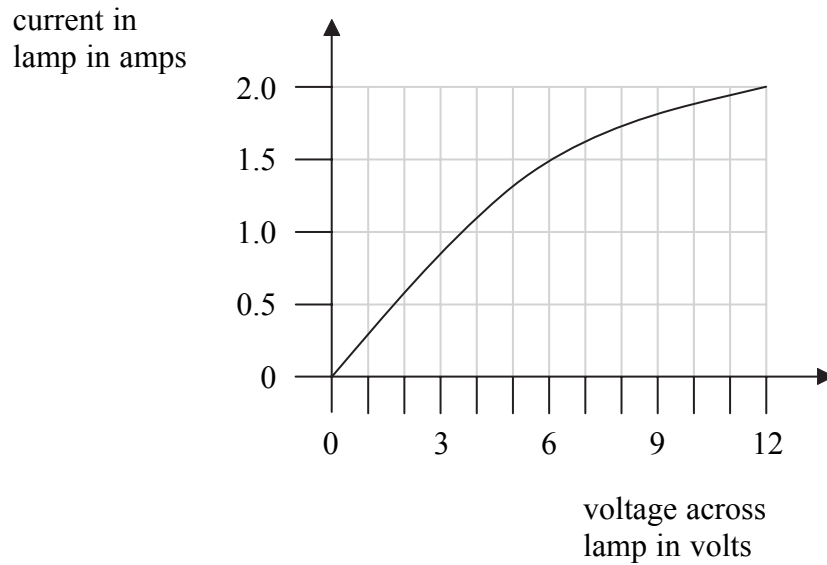
C



D

Use this information to answer questions 30, 31 and 32.

Jason and Zubeda present their results as a graph.



30.

$$V = I \times R$$

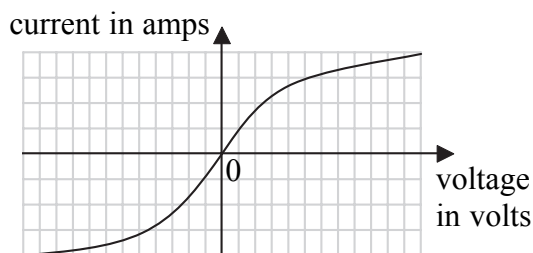
What is the resistance of the filament lamp at 6 V?

- A 0.25 Ω
- B 1.5 Ω
- C 4.0 Ω
- D 9.0 Ω

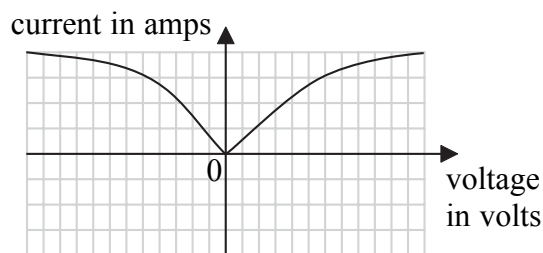
31. Which of these is a correct analysis of their graph?

- A The resistance of the lamp increases when the current increases
- B The resistance of the lamp decreases when the current increases
- C The current in the lamp is directly proportional to the voltage across it
- D The voltage across the lamp is directly proportional to the current in it

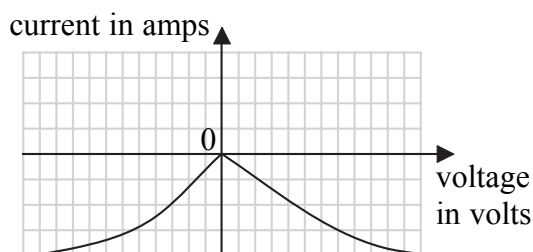
32. Jason and Zubeda repeat their experiment. They also include measurements made with the battery connections reversed. Which graph shows their new results?



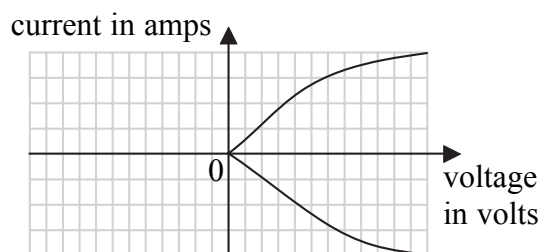
A



B



C



D

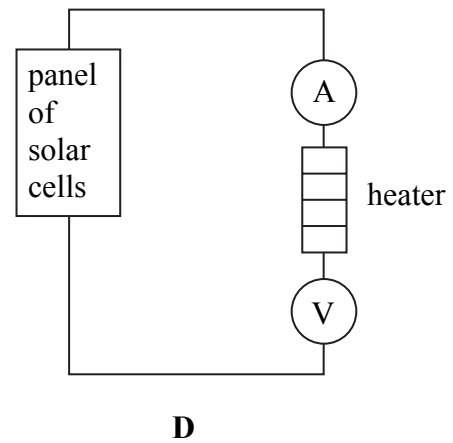
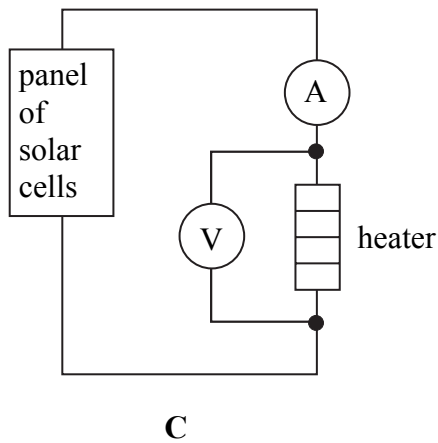
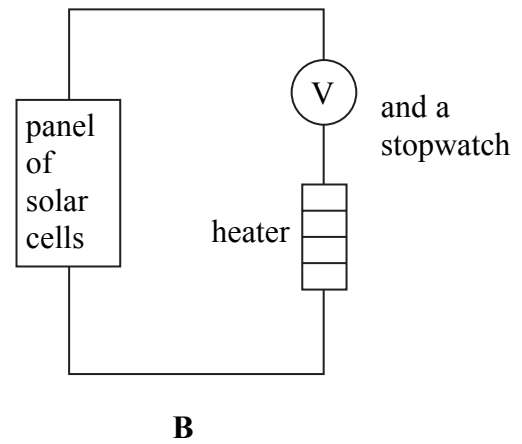
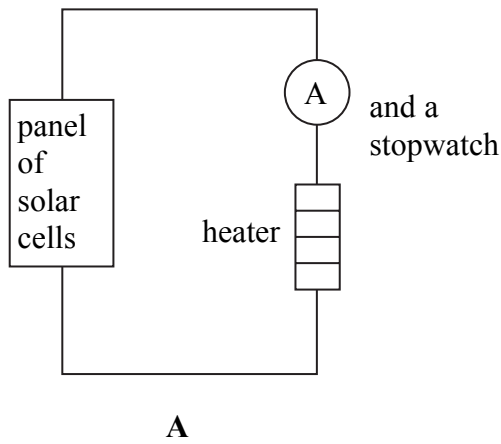
Solar cells

Peter and Sarah are investigating solar cells. They shine light from three different coloured lamps of the same brightness onto a panel of solar cells. They measure the power output of the cells. Here are some of their results.

colour of light	power output in W		
	1st attempt	2nd attempt	3rd attempt
red	20.0	20.2	19.8
yellow	19.8	20.0	20.2
blue	20.0	19.5	20.5

33. Which of these statements is a correct analysis of these results?
- A The results are not reliable enough
 - B They should have used digital meters to get more accurate results
 - C Solar cells give the greatest power output with red light
 - D The power output does not depend on the colour of light used

34. To measure the power output, Peter and Sarah connect the panel of solar cells to an electrical heater.
Which of these should they use to measure electrical power?

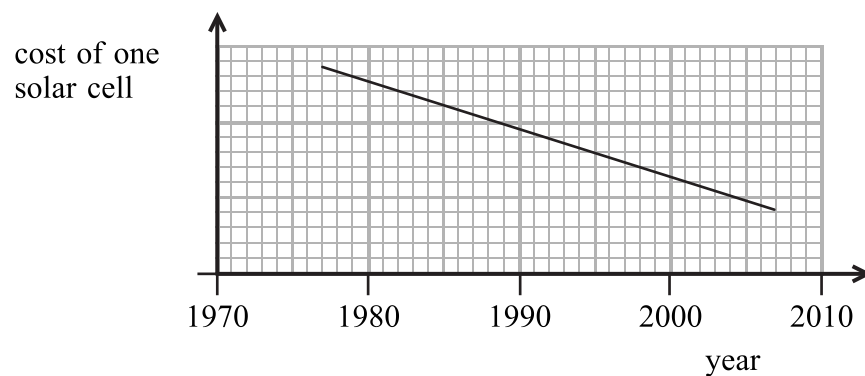
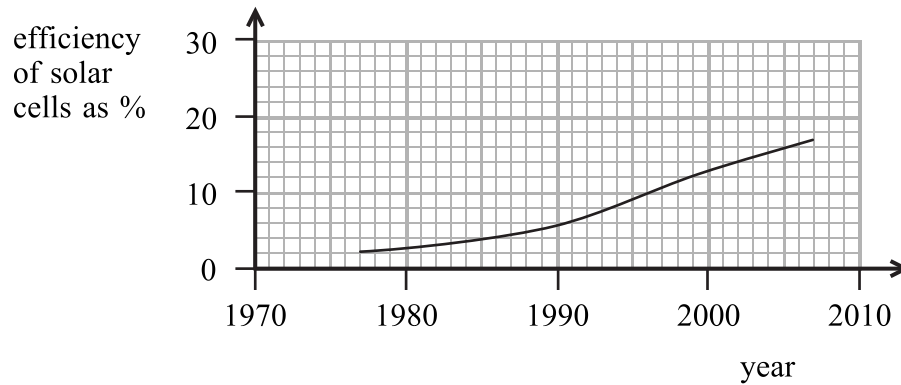


35. $\text{cost} = \text{power} \times \text{time} \times \text{cost of 1 kW h}$

A large solar panel supplies an average of 500 W of electrical power.
The cost of 1 kW h of electrical energy is 12.5p.
How long will it take the solar panel to produce £1 worth of electrical energy?

- A** 0.6 hours
- B** 16 hours
- C** 40 hours
- D** 62.5 hours

36. The graphs give some data about changes in solar cell efficiency and the cost of the electrical energy they provide.



Which of these statements does **not** follow from the data?

- A Solar cells are less efficient because their power output is increasing
 - B The efficiency of solar cells now is about 17%
 - C Solar cells are becoming more efficient
 - D New solar cells are more cost effective than those produced in the 1980s
37. The widespread use of solar cells will only happen when
- A the efficiency of solar cells is near 100%
 - B global warming raises the temperature of the Earth
 - C the cost of solar cells is reduced
 - D solar cells that produce high voltage alternating current are invented

Household electrics

John has a small wind turbine to provide electricity for his workshop.
He uses batteries to store electrical energy for those days when there is no wind.

38. John's batteries are labelled "lead acid 12 V".
Which row of the table is correct for an arrangement of these batteries that would provide 60 V?

	type of battery	arrangement of batteries
A	rechargeable	5 batteries in parallel
B	rechargeable	5 batteries in series
C	dry cell	5 batteries in parallel
D	dry cell	5 batteries in series

39. John uses his 60 V battery to operate a 30 W lamp.
The capacity of his battery is 120 A h.
For how long could he power the lamp using just the battery?

- A 2 hours
- B 4 hours
- C 60 hours
- D 240 hours

40. Sometimes John has to switch over to using mains electricity.
His mains circuit includes a residual current circuit breaker (RCCB).
Here are two statements about the residual current circuit breaker.

- 1 The RCCB protects the user of a faulty appliance.
- 2 The RCCB must be replaced each time it switches off the mains supply.

The correct statements are

- A 1 only
- B 2 only
- C both 1 and 2
- D neither

TOTAL FOR HIGHER TIER PAPER: 24 MARKS

END