Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
June 2005

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

SCIENCE: SINGLE AWARD A (MODULAR)   **346017**
Energy and Electricity (Module 17)

Tuesday 28 June 2005   Morning Session

In addition to this paper you will require:
- a black ball-point pen;
- an answer sheet.

You may use a calculator.

Time allowed: 30 minutes

Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title "Energy and Electricity" printed on it.
- Attempt **one Tier only**, **either** the Foundation Tier **or** the Higher Tier.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only. Rough work may be done on the question paper.

Instructions for recording answers

- Use a **black ball-point pen**.

- For each answer **completely fill in the circle** as shown:

- Do **not** extend beyond the circles.

- If you want to change your answer, **you must**
  cross out your original answer, as shown:

- If you change your mind about an answer you have crossed out
  and now want to choose it, draw a ring around the cross as shown:

Information
- The maximum mark for this paper is 36.

Advice
- Do **not** choose more responses than you are asked to. You will lose marks if you do.
- Make sure that you hand in both your answer sheet and this question paper at the end of the test.
- If you start to answer on the wrong side of the answer sheet by mistake, make sure that you cross out **completely** the work that is not to be marked.

         346017

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.

The Higher Tier starts on page 14 of this booklet.

FOUNDATION TIER

SECTION A

Questions **ONE** to **FIVE**.

In these questions match the words in the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

The table shows some electrical symbols.
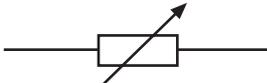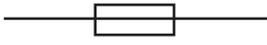
Device	Symbol
1	
2	
3	
4	
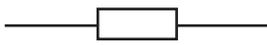
Match words from the list with the numbers **1– 4** in the table.

fuse

resistor

thermistor

variable resistor

QUESTION TWO

The diagram shows the inside of a three-pin plug.

Green and yellow

Blue
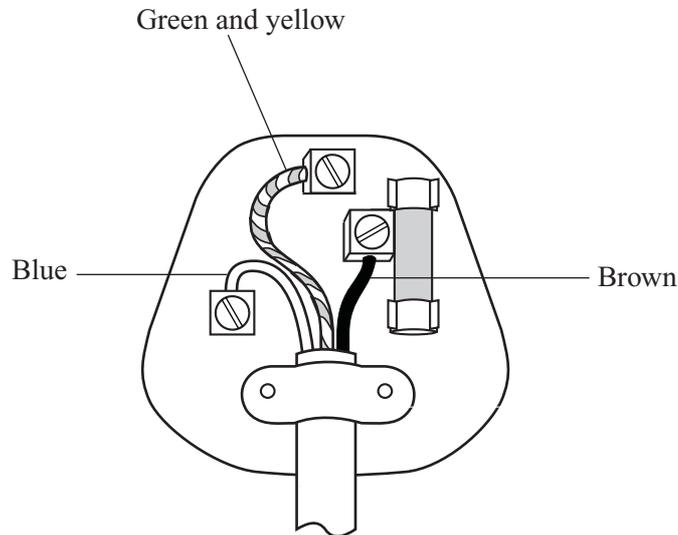
Brown

Match words from the list with the numbers **1–4** in the sentences.

earth terminal

fuse

live terminal

neutral terminal

The brown wire connects the appliance to the . . . . . **1** . . . . . of the mains supply.

A . . . . . **2** . . . . . is fitted inside the plug between the brown wire and the mains supply.

The blue wire connects the appliance to the . . . . . **3** . . . . . .

The green and yellow wire connects the appliance to the . . . . . **4** . . . . . .

Turn over ▶

QUESTION THREE

Power stations can cause problems for the environment.

Match words from the list with the numbers **1–4** in the table.

coal-fired

nuclear

tidal barrage

wind farm

Type of power station	Problem
1	destroys the habitat of mud-living organisms
2	produces noise pollution
3	produces radioactive waste
4	releases sulphur dioxide

QUESTION FOUR

The resistance of most electrical devices can change.

Match words from the list with the numbers **1–4** in the sentences.

a diode

a filament lamp

an LDR

a thermistor

The resistance of . . . . . **1** . . . . . decreases as it gets hot.

The resistance of . . . . . **2** . . . . . increases as it gets hot.

Current flows through . . . . . **3** . . . . . in one direction only. Its resistance is very high in the reverse direction.

The resistance of . . . . . **4** . . . . . decreases as the surroundings become brighter.

QUESTION FIVE

The table shows how much heat is lost through different parts of a house before insulation and after insulation. The cost of insulation is also shown.

Part of house	Energy lost per second before insulation in kilojoules	Energy lost per second after insulation in kilojoules	Cost of insulation in £
Floors	1.25	0.8	800
Roof	3.0	1.3	500
Walls	2.0	1.0	1500
Windows	0.75	0.5	3000

Match words from the list with the numbers **1–4** in the sentences.

floors

roof

walls

windows

Insulating the . . . . . **1** . . . . . halves the heat lost through this part of the house.

More heat is lost through the . . . . . **2** . . . . . than through any other part of the house.

The easiest way to insulate the . . . . . **3** . . . . . is with carpet.

The part of the house which is least cost effective to insulate is the . . . . . **4** . . . . . .

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

SECTION B

Questions **SIX** and **SEVEN**.

In these questions choose the best **two** answers.

Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION SIX

The radioactive substances that are found within the Earth can release energy.

Which **two** of the following make use of this energy?

fossil fuel power stations

geothermal power stations

nuclear power stations

solar cells

tidal barrages

QUESTION SEVEN

A 4 Ω resistor is connected in series with an 8 Ω resistor.

The circuit is shown below.

Which **two** of the statements **P**, **Q**, **R**, **S** and **T** are correct?

    P   **the current through each resistor is the same**

    Q   **the current through the 4 Ω resistor is twice as big as the current through the 8 Ω resistor**

    R   **the potential difference (voltage) across the 4 Ω resistor is twice as big as that across the 8 Ω resistor**

    S   **the potential difference across each resistor is the same**

    T   **the total resistance is 12 Ω**

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

SECTION C

Questions **EIGHT** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION EIGHT

> You may find the following formulae useful when answering parts of this question.
>
> energy transferred $=$ power $\times$ time
> (joule, J)   (watt, W)   (second, s)
>
> energy transferred $=$ power $\times$ time
> (kilowatt-hour, kWh)   (kilowatt, kW)   (hour, h)
>
> total cost $=$ number of Units $\times$ cost per Unit

The diagram shows a 100 W filament lamp.
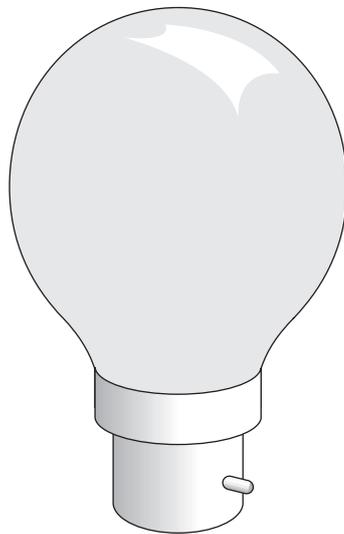
8.1 How many joules of energy does the lamp transfer in one minute?

A   24

B   150

C   6 000

D   15 000

8.2 How many kilowatt-hours of energy would the lamp transfer in one hour?

A 0.1

B 1

C 10

D 100

8.3 One kilowatt-hour is also called . . . . .

A one watt.

B one kilojoule.

C one kilojoule-hour.

D one Unit.

8.4 Electricity costs 8 p per Unit.

How much would it cost to use a 3 kW appliance for 4 hours?

A 1.5 p

B 6 p

C 96 p

D £9.60

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

This question is about different types of power station.

9.1 One advantage of wind farms is that they . . . . .

    A   can produce a reliable output in any wind speed.

    B   do not release carbon dioxide into the air.

    C   have no effect on the environment.

    D   produce electricity at no cost.

9.2 Some power stations are classed as 'reliable energy resources'.

This is because they . . . . .

    A   can produce electricity at any time.

    B   can start up very quickly.

    C   have a very good safety record.

    D   use fuels which will not run out.

9.3 Power stations vary in their start-up times.

Which row in the table is correct?

	Shortest start-up time ⟶			Longest start-up time
A	coal	oil	gas	nuclear
B	gas	oil	coal	nuclear
C	nuclear	coal	oil	gas
D	oil	nuclear	gas	coal

9.4 One argument in favour of building more nuclear power stations is that . . . . .

    A   building costs are lower than for other types of power station.

    B   it is easy to store nuclear waste safely.

    C   they do not add to the greenhouse effect when they generate electricity.

    D   uranium, the main nuclear fuel, is renewable.

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

QUESTION TEN

The table gives the sources of carbon dioxide emissions in the UK in one year.

Emission source	Amount of carbon dioxide in million tonnes
Power stations	194
Other industry	125
Road transport	110
Domestic fuel use	88
Commercial/public fuel use	33
Refineries	18
Shipping	7
Agriculture	4
Civil aviation	4
Railways	4
Total	**587**

10.1 Carbon dioxide emissions to the atmosphere are the main cause of . . . . .

A   acid rain.

B   global warming.

C   increased rates of asthma in children.

D   the hole in the ozone layer.

10.2 Which fuel used in power stations makes the most carbon dioxide for each Unit of electricity produced?

A   Coal

B   Gas

C   Oil

D   Uranium

10.3 Which two sources of carbon dioxide together account for more than 50 % of the total emissions?

   A   Other industry and road transport

   B   Power stations and domestic fuel use

   C   Power stations and other industry

   D   Road transport and domestic fuel use

10.4 Better home insulation could reduce carbon dioxide emissions from . . . . .

   A   other industry and domestic fuel use.

   B   power stations and domestic fuel use.

   C   power stations and other industry.

   D   road transport and domestic fuel use.

END OF TEST

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.

The Foundation Tier is earlier in this booklet.

HIGHER TIER

SECTION A

Questions **ONE** and **TWO**.

In these questions match the words in the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

The table shows how much heat is lost through different parts of a house before insulation and after insulation. The cost of insulation is also shown.

Part of house	Energy lost per second before insulation in kilojoules	Energy lost per second after insulation in kilojoules	Cost of insulation in £
Floors	1.25	0.8	800
Roof	3.0	1.3	500
Walls	2.0	1.0	1500
Windows	0.75	0.5	3000

Match words from the list with the numbers **1–4** in the sentences.

floors

roof

walls

windows

Insulating the . . . . . **1** . . . . . halves the heat lost through this part of the house.

More heat is lost through the . . . . . **2** . . . . . than through any other part of the house.

The easiest way to insulate the . . . . . **3** . . . . . is with carpet.

The part of the house which is least cost effective to insulate is the . . . . . **4** . . . . . .

QUESTION TWO

The list shows how the resistance of some components can change.

Match phrases **D**, **E**, **F** and **G** in the list with the numbers **1– 4** in the table.

    D   **it depends on the direction of the current**

    E   **it increases as the light intensity decreases**

    F   **it increases as the temperature decreases**

    G   **it increases as the temperature increases**

How the resistance changes	Symbol of component
1	⊗
2	LDR symbol
3	diode symbol
4	thermistor symbol
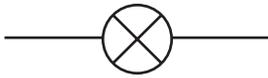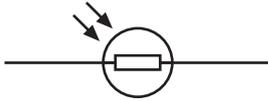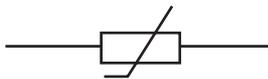
TURN OVER FOR THE NEXT QUESTION

Turn over ▶

SECTION B

Questions **THREE** and **FOUR**.

In these questions choose the best **two** answers.

Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

A 4 Ω resistor is connected in series with an 8 Ω resistor.

The circuit is shown below.

Which **two** of the statements **P**, **Q**, **R**, **S** and **T** are correct?

   P   the current through each resistor is the same

   Q   the current through the 4 Ω resistor is twice as big as the current through the 8 Ω resistor

   R   the potential difference (voltage) across the 4 Ω resistor is twice as big as that across the 8 Ω resistor

   S   the potential difference across each resistor is the same

   T   the total resistance is 12 Ω

QUESTION FOUR

This question is about the mains electricity supply in the UK.

Which **two** of the statements **J**, **K**, **L**, **M** and **N** are correct?

     J   the earth wire is connected to the live terminal of a plug

     K   the fuse in a plug should have a lower value than the normal current flowing through the appliance

     L   the live terminal of the supply alternates between positive and negative voltages

     M   the neutral terminal of the supply stays at a voltage close to zero with respect to earth

     N   the mains supply is d.c. and stays at a constant voltage

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

SECTION C

Questions **FIVE** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION FIVE

> You may find the following formulae useful when answering parts of this question.
>
> energy transferred = power × time
> (joule, J)   (watt, W)   (second, s)
>
> energy transferred = power × time
> (kilowatt-hour, kWh)   (kilowatt, kW)   (hour, h)
>
> total cost = number of Units × cost per Unit

The diagram shows a 100 W filament lamp.
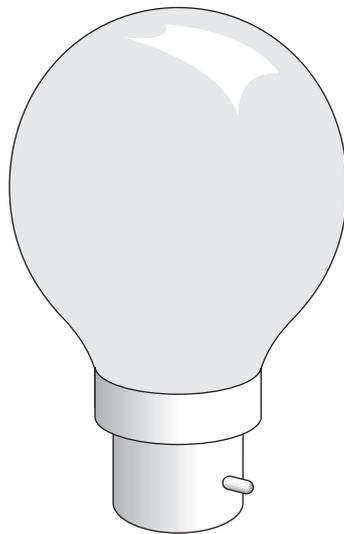
5.1   How many joules of energy does the lamp transfer in one minute?

A   24

B   150

C   6 000

D   15 000

5.2 How many kilowatt-hours of energy would the lamp transfer in one hour?

A   0.1

B   1

C   10

D   100

5.3 One kilowatt-hour is also called . . . . .

A   one watt.

B   one kilojoule.

C   one kilojoule-hour.

D   one Unit.

5.4 Electricity costs 8 p per Unit.

How much would it cost to use a 3 kW appliance for 4 hours?

A   1.5 p

B   6 p

C   96 p

D   £9.60

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

QUESTION SIX

This question is about different types of power station.

6.1 One advantage of wind farms is that they . . . . .

    A can produce a reliable output in any wind speed.

    B do not release carbon dioxide into the air.

    C have no effect on the environment.

    D produce electricity at no cost.

6.2 Some power stations are classed as 'reliable energy resources'.

This is because they . . . . .

    A can produce electricity at any time.

    B can start up very quickly.

    C have a very good safety record.

    D use fuels which will not run out.

6.3 Power stations vary in their start-up times.

Which row in the table is correct?

	Shortest start-up time ⟶			Longest start-up time
A	coal	oil	gas	nuclear
B	gas	oil	coal	nuclear
C	nuclear	coal	oil	gas
D	oil	nuclear	gas	coal

6.4 One argument in favour of building more nuclear power stations is that . . . . .

    A   building costs are lower than for other types of power station.

    B   it is easy to store nuclear waste safely.

    C   they do not add to the greenhouse effect when they generate electricity.

    D   uranium, the main nuclear fuel, is renewable.

TURN OVER FOR THE NEXT QUESTION

QUESTION SEVEN

The table gives the sources of carbon dioxide emissions in the UK in one year.

Emission source	Amount of carbon dioxide in million tonnes
Power stations	194
Other industry	125
Road transport	110
Domestic fuel use	88
Commercial/public fuel use	33
Refineries	18
Shipping	7
Agriculture	4
Civil aviation	4
Railways	4
Total	**587**

7.1 Carbon dioxide emissions to the atmosphere are the main cause of . . . . .

    A   acid rain.

    B   global warming.

    C   increased rates of asthma in children.

    D   the hole in the ozone layer.

7.2 Which fuel used in power stations makes the most carbon dioxide for each Unit of electricity produced?

    A   Coal

    B   Gas

    C   Oil

    D   Uranium

7.3 Which two sources of carbon dioxide together account for more than 50 % of the total emissions?

    A   Other industry and road transport

    B   Power stations and domestic fuel use

    C   Power stations and other industry

    D   Road transport and domestic fuel use

7.4 Better home insulation could reduce carbon dioxide emissions from . . . . .

    A   other industry and domestic fuel use.

    B   power stations and domestic fuel use.

    C   power stations and other industry.

    D   road transport and domestic fuel use.

TURN OVER FOR THE NEXT QUESTION

QUESTION EIGHT

The diagram shows a filament lamp connected to a 6 V supply. Meters are connected so that values of current and potential difference (voltage) can be measured.
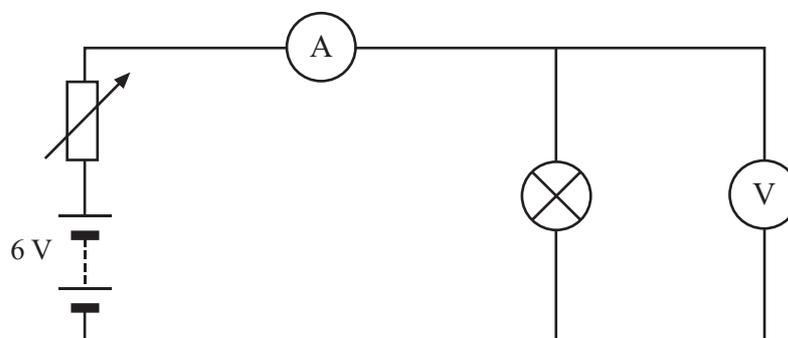
The graph of the results is shown.
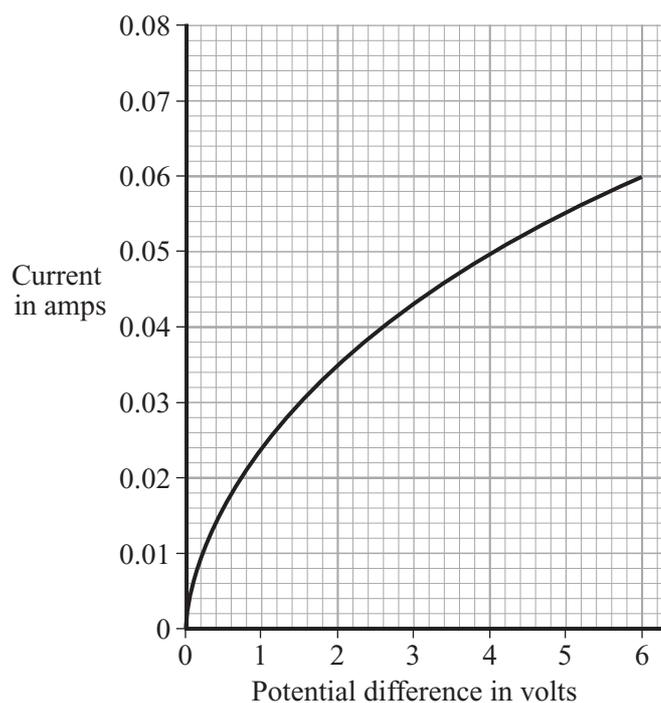
8.1 The graph shows that, as the current increases, the resistance of the filament . . . . .

  A   becomes larger and then smaller.

  B   decreases.

  C   increases.

  D   stays the same.

8.2   When the potential difference across the lamp is 6 V, the resistance of the lamp is . . . . .

    A   0.01 Ω

    B   0.1 Ω

    C   10 Ω

    D   100 Ω

8.3   When a current of 0.03 A flows through the filament, the resistance of the lamp is . . . . .

    A   0.05 Ω

    B   0.5 Ω

    C   20 Ω

    D   50 Ω

8.4   The circuit shows a voltmeter connected in parallel with the lamp.

The voltmeter will not affect the ammeter readings if it . . . . .

    A   has an internal battery.

    B   has a very large resistance.

    C   has a very small resistance.

    D   takes sufficient current.

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

The diagram shows some of the ways that energy is transferred from the inside of a classroom on a cold day.
It also shows what improvements can be made to the classroom to reduce these energy transfers.
The table shows the cost of the improvements and how much money they save each year.

750 W through windows (can be reduced to 500 W by double glazing)

2000 W through walls (can be reduced to 1250 W by cavity wall insulation)

1000 W through draughts (can be reduced to 500 W by draught proofing)

1000 W through floors (can be reduced to 750 W by thick carpets)
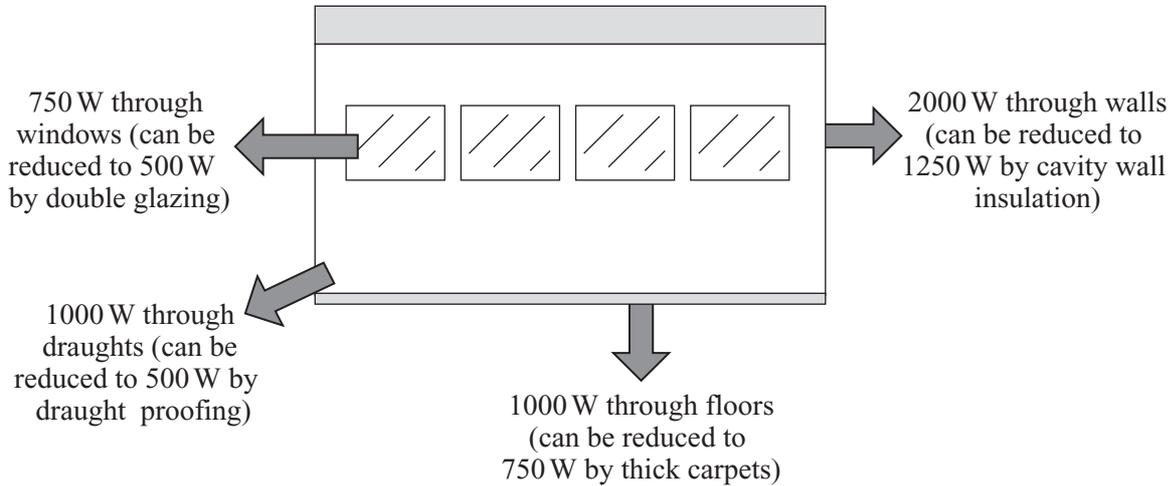
Improvement	Cost	Saving per year
Cavity wall insulation	£450	£150
Double glazing	£1500	£50
Draught proofing	£50	£100
Thick carpets	£300	£50

9.1 Which improvement reduces the energy transfer by the largest amount?

A Cavity wall insulation

B Double glazing

C Draught proofing

D Thick carpets

9.2   Each improvement is designed to reduce energy transfer through part of the classroom.

Which improvement reduces this energy transfer by the largest percentage?

A   Cavity wall insulation

B   Double glazing

C   Draught proofing

D   Thick carpets

9.3   The time it takes for an improvement to pay for itself is called the pay-back time.

What is the pay-back time for thick carpets?

A $\frac{1}{6}$ of a year

B $\frac{1}{2}$ of a year

C   2 years

D   6 years

9.4   Which improvement has the shortest pay-back time?

A   Cavity wall insulation

B   Double glazing

C   Draught proofing

D   Thick carpets

TURN OVER FOR THE NEXT QUESTION

QUESTION TEN

> You may find the following formulae useful when answering parts of this question.
>
> energy transferred   =   power   ×   time
> (kilowatt-hour, kWh)   (kilowatt, kW)   (hour, h)
>
> total cost = number of Units × cost per Unit

An Indian village is many miles away from a supply of mains electricity.
The Sun shines for at least a few hours nearly every day.
The villagers want a supply of electricity for a radio receiver in a community building.
The table shows the costs of two different ways of providing the electricity over a 20-year period.

Way of providing electricity	Equipment cost	Cost of a set of batteries	Number of sets of batteries needed
Solar cells and rechargeable batteries	£50.00	£10.00	4
'Throwaway' batteries	Zero	£2.50	80

10.1   What are the total costs over the 20-year period?

	Solar cells and rechargeable batteries	'Throwaway' batteries
A	£60.00	£12.50
B	£60.00	£200.00
C	£90.00	£12.50
D	£90.00	£200.00

10.2   One disadvantage of using solar cells and rechargeable batteries is that . . . . .

A   new batteries are needed more often.

B   the radio could not be used at night.

C   they are more expensive in the long run.

D   they cost more in the first place.

10.3 A group of solar cells has a maximum output of 1 kW.

The group of cells, when used in the UK, produces $\frac{1}{10}$ of its maximum output.

The group of cells costs £10 000 and has an expected life of 200 000 hours.
The cells have no maintenance costs.

What is the cost of each Unit of electricity produced by the group of cells?

A 5 p

B 50 p

C £2.50

D £5.00

10.4 Electricity from solar cells is more expensive than electricity generated in power stations.

Which of the following would make the cost of electricity from solar cells cheaper?

A A decrease in the cost of fuel for normal types of power station

B Developing solar cells that are smaller

C Developing other alternative energy technologies

D Reducing the cost of solar cells by mass production

END OF TEST

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