

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education  
Winter 2005



**SCIENCE: DOUBLE AWARD A (MODULAR)      346009**  
**PHYSICS A (MODULAR)**  
**Energy (Module 09)**

Thursday 24 November 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” 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:
 

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

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

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

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

- 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:
 

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

**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.

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.  
The Higher Tier starts on page 14 of this booklet.

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**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.

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**QUESTION ONE**

Energy transfers take place in a television set.

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

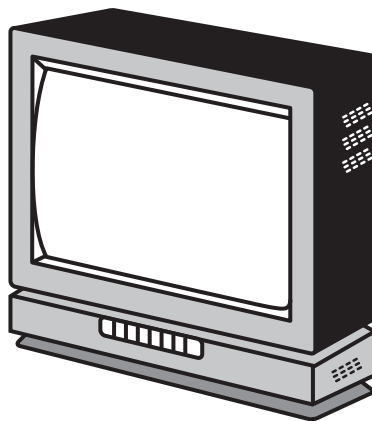
**electrical**

**heat**

**light**

**sound**

The screen is designed to  
produce . . . . . **1** . . . . . energy.

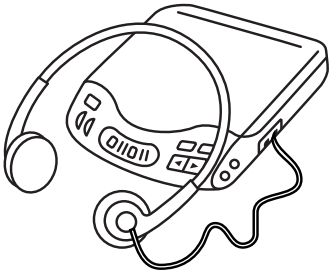


Ventilation slots help the set  
to lose . . . . . **2** . . . . . energy.

The loudspeaker changes . . . . . **3** . . . . .  
energy into . . . . . **4** . . . . . energy.

**QUESTION TWO**

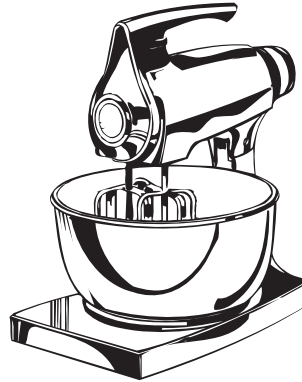
The appliances shown in the drawings transfer some of their energy as useful energy and some as wasted energy.



CD player



Cell



Food mixer



Toaster

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

**CD player**

**cell**

**food mixer**

**toaster**

Appliance	Useful energy output	Wasted energy
<b>1</b>	electricity	heat
<b>2</b>	heat	light
<b>3</b>	kinetic	heat and sound
<b>4</b>	sound	heat

**Turn over ►**

**QUESTION THREE**

A mug of hot tea cools down.



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

**conduction**

**convection**

**emission**

**radiation**

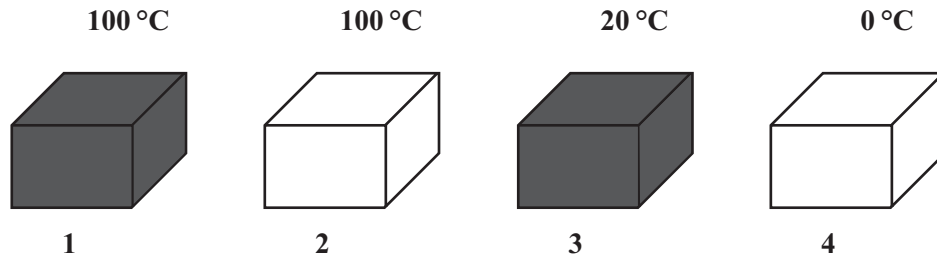
Heat moves through the sides of the mug by . . . . . **1** . . . . .

Air above the mug gets hot and rises. This is called . . . . . **2** . . . . .

The . . . . . **3** . . . . . of infra red . . . . . **4** . . . . . takes place from the outside of the mug.

**QUESTION FOUR**

The diagram shows four metal blocks. They are all the same size and are made of aluminium. Two are shiny and the other two are painted black. The blocks are at different temperatures.



Each of the blocks is in a room where the temperature is 20 °C.

Match statements from the list with the blocks 1–4 to describe what will happen to each block.

**it will cool down rapidly**

**it will cool down slowly**

**it will not change in temperature**

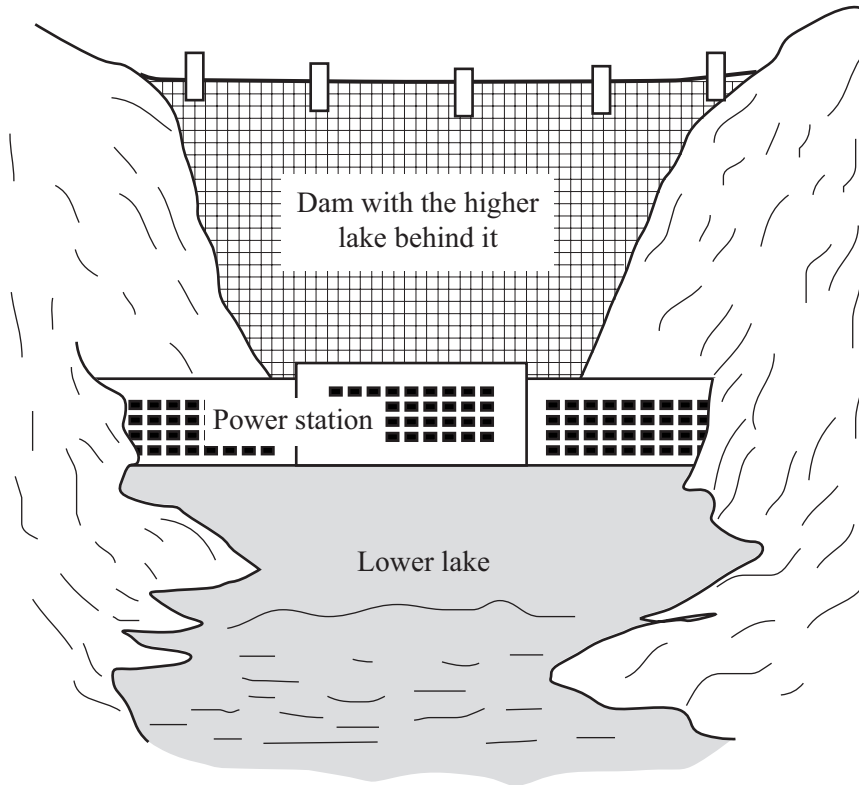
**it will warm up**

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**QUESTION FIVE**

The drawing shows a hydroelectric power station. Water falls from the higher lake to the lower lake. It passes through turbines near the bottom of the dam.



Match words from the list with the numbers 1–4 in the sentences to explain how the power station works.

**electrical**

**gravitational potential**

**heat**

**kinetic**

The water in the higher lake has . . . . . **1** . . . . . energy.

When the water falls, energy is transferred as . . . . . **2** . . . . . energy.

This energy turns the turbines, driving generators which produce . . . . . **3** . . . . . energy.

The water in the lower lake is slightly warmer than the water in the higher lake.

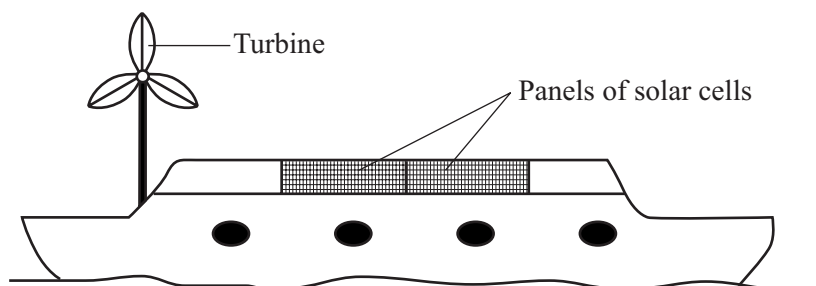
This is because some of the energy is transferred as . . . . . **4** . . . . . energy.

**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**

This canal boat is using renewable sources of energy to recharge its batteries.

Which **two** energy sources are being used by the canal boat?**the Sun****tides****water behind a dam****waves on the water****wind****QUESTION SEVEN**

About a quarter of our electricity is generated in nuclear power stations.

Which **two** statements give advantages of using nuclear power stations?**they do not cause acid rain****they do not produce greenhouse gases****they do not work by heating water to produce steam****they produce radioactive waste****uranium is a renewable energy resource****Turn over ►**

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**SECTION C**Questions **EIGHT** to **TEN**.

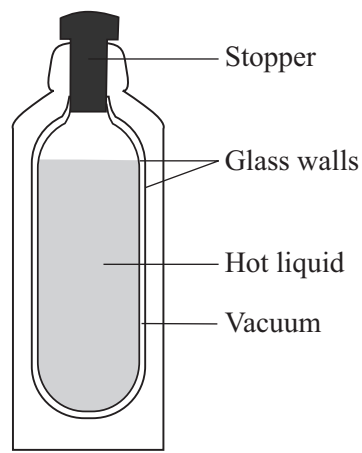
Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

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**QUESTION EIGHT**

The diagram shows the inside of a vacuum flask. It is designed to keep its contents hot.



- 8.1** Why is there a vacuum between the glass walls?
- A** Because radiation does not travel through a vacuum
  - B** To keep the inside of the flask cool
  - C** To make the flask lighter
  - D** To prevent convection currents
- 8.2** The stopper reduces heat loss by . . . . .
- A** conduction through the glass walls.
  - B** conduction through the liquid.
  - C** convection in the air.
  - D** convection in the liquid.



**8.3** The glass walls are shiny because they have a silvered surface.

This is to . . . . .

- A** reduce conduction through the walls.
- B** reflect convected heat back into the flask.
- C** reflect radiation back into the flask.
- D** stop radiation from outside entering the flask.

**8.4** The insides of some flasks are made from thin polished metal instead of glass. This makes them stronger.

Which row of the table is correct for how and why the hot liquid will cool down in a metal flask?

	<b>How</b>	<b>Why</b>
<b>A</b>	more slowly	because metal is a poorer heat conductor than glass
<b>B</b>	more slowly	because more radiation is reflected back
<b>C</b>	more quickly	because metal does not keep such a good vacuum
<b>D</b>	more quickly	because metal is a better heat conductor than glass

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**QUESTION NINE**

You may find the following formula useful when answering this question.

$$\begin{array}{l} \text{energy transferred} \\ \text{(kilowatt-hour, kWh)} \end{array} = \begin{array}{l} \text{power} \\ \text{(kilowatt, kW)} \end{array} \times \begin{array}{l} \text{time} \\ \text{(hour, h)} \end{array}$$

The diagram shows an electricity meter reading on two different dates.

7	2	3	4
---	---	---	---

**1<sup>st</sup> April 2005**

8	4	6	8
---	---	---	---

**1<sup>st</sup> July 2005**

- 9.1** How many Units were used between 1<sup>st</sup> April and 1<sup>st</sup> July 2005?
- A 34
  - B 234
  - C 1000
  - D 1234
- 9.2** What else would you need to know to work out the cost of the electricity used between these dates?
- A The cost of one Unit
  - B The maximum current in amps
  - C The time between the readings
  - D The voltage of the supply

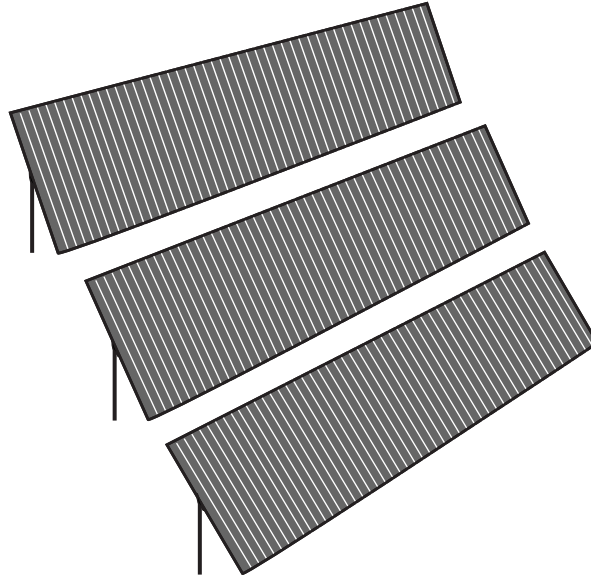
- 9.3** What is measured by the Units shown on the meter?
- A** The amount of energy used
  - B** The number of electrons that have passed through
  - C** The power of the appliances used
  - D** The time for which the supply has been used
- 9.4** Which of the following would use one Unit of electricity?
- A** A 1 kilowatt heater switched on for 1 hour
  - B** A 1 kilowatt heater switched on for 1 second
  - C** A 100 watt light bulb switched on for 10 minutes
  - D** A 1 watt indicator lamp switched on for 1 second

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**QUESTION TEN**

The drawing shows an array of solar cells.



When it is sunny, the array produces between 1 kW and 4 kW of electricity. It can provide 7500 kWh per year.

**10.1** The words *between 1 kW and 4 kW* describe the . . . . .

- A efficiency.
- B energy output.
- C number of Units used.
- D power output.

**10.2** The value of *7500 kWh* gives the . . . . .

- A electrical energy output.
- B electrical power input.
- C electrical power output.
- D solar energy input.

**10.3** Solar cells transfer . . . . .

- A electrical energy to light energy.
- B electrical energy to thermal energy.
- C light energy to electrical energy.
- D thermal energy to light energy.

**10.4** A disadvantage of using solar cells is that . . . . .

- A they are expensive to make.
- B they can be used only in remote locations.
- C they can be used only where very small amounts of electricity are needed.
- D they produce a lot of noise.

**END OF TEST**

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.  
The Foundation Tier is earlier in this booklet.

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## HIGHER TIER

### SECTION A

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

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

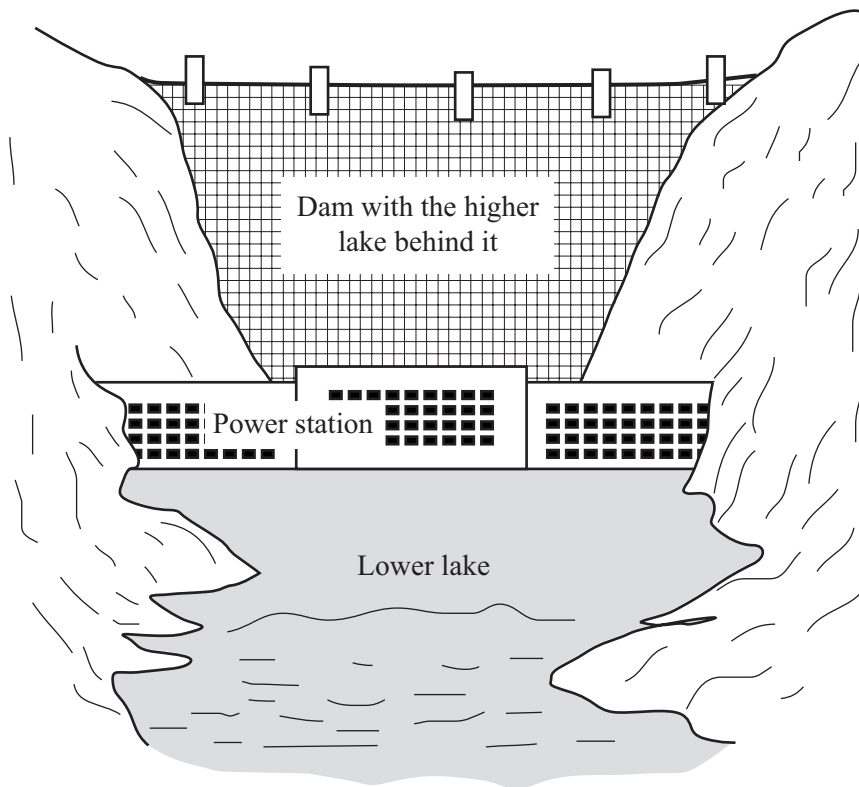
Use **each** answer only **once**.

Mark your choices on the answer sheet.

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#### QUESTION ONE

The drawing shows a hydroelectric power station. Water falls from the higher lake to the lower lake. It passes through turbines near the bottom of the dam.



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Match words from the list with the numbers **1–4** in the sentences to explain how the power station works.

**electrical**

**gravitational potential**

**heat**

**kinetic**

The water in the higher lake has . . . . . **1** . . . . . energy.

When the water falls, energy is transferred as . . . . . **2** . . . . . energy.

This energy turns the turbines, driving generators which produce . . . . . **3** . . . . . energy.

The water in the lower lake is slightly warmer than the water in the higher lake.

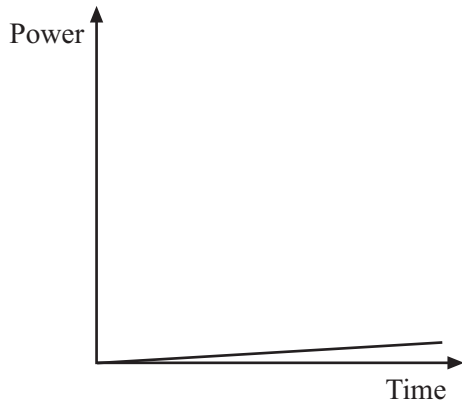
This is because some of the energy is transferred as . . . . . **4** . . . . . energy.

**TURN OVER FOR THE NEXT QUESTION**

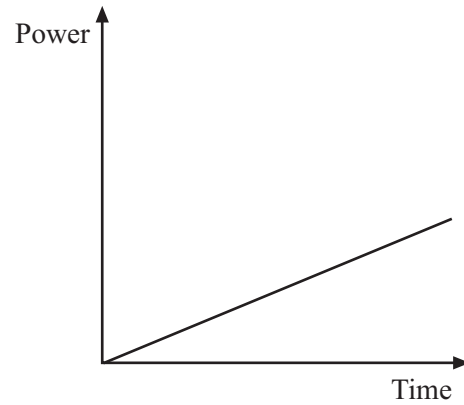
**Turn over ►**

**QUESTION TWO**

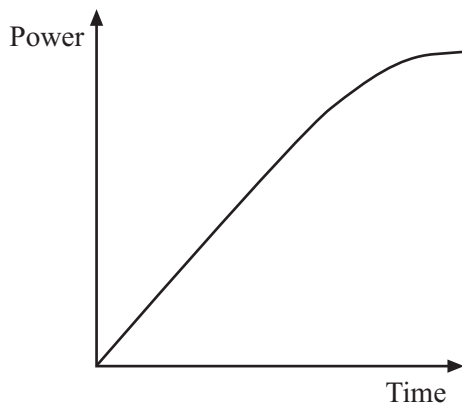
The time taken to start up different types of power station varies. The graphs show how the power produced changes after the power station has been switched on. All the graphs have the same scales.



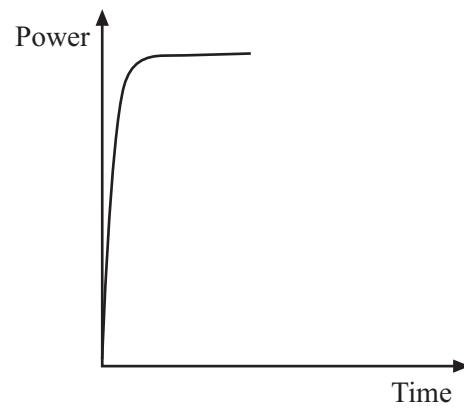
Graph 1



Graph 2



Graph 3



Graph 4

Match words from the list with the graphs 1–4.

**coal-fired power station**

**hydroelectric power station**

**nuclear power station**

**oil-fired power station**



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**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.

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**QUESTION THREE**

About a quarter of our electricity is generated in nuclear power stations.

Which **two** statements give advantages of using nuclear power stations?**they do not cause acid rain****they do not produce greenhouse gases****they do not work by heating water to produce steam****they produce radioactive waste****uranium is a renewable energy resource****QUESTION FOUR**

This question is about people's use of energy. Read the passage before you answer the question.

Fossil fuels include coal, crude oil and natural gas. It has been estimated that the world's oil will run out by 2040, natural gas by 2050 and coal by the year 2200. At present, a quarter of the world's population uses 70 % of the Earth's fossil fuels.

Which **two** of the statements **J**, **K**, **L**, **M** and **N** are correct?**J** according to the passage, 75 % of the world's population uses only 30 % of the Earth's fossil fuels**K** for each megajoule of energy released, natural gas produces more carbon dioxide than coal does**L** no renewable energy sources are mentioned in the passage**M** nuclear fuel is a source of renewable energy**N** wood is another fossil fuel

Turn over ►

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**SECTION C**Questions **FIVE** to **TEN**.

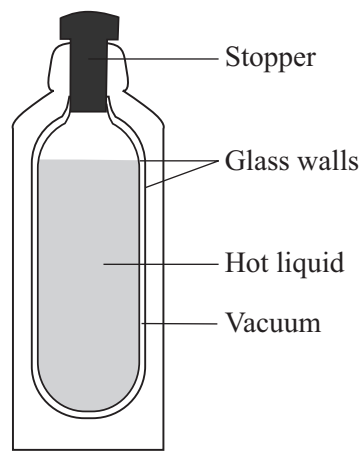
Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

---

**QUESTION FIVE**

The diagram shows the inside of a vacuum flask. It is designed to keep its contents hot.



- 5.1** Why is there a vacuum between the glass walls?
- A** Because radiation does not travel through a vacuum
  - B** To keep the inside of the flask cool
  - C** To make the flask lighter
  - D** To prevent convection currents
- 5.2** The stopper reduces heat loss by . . . . .
- A** conduction through the glass walls.
  - B** conduction through the liquid.
  - C** convection in the air.
  - D** convection in the liquid.

**5.3** The glass walls are shiny because they have a silvered surface.

This is to . . . . .

- A** reduce conduction through the walls.
- B** reflect convected heat back into the flask.
- C** reflect radiation back into the flask.
- D** stop radiation from outside entering the flask.

**5.4** The insides of some flasks are made from thin polished metal instead of glass. This makes them stronger.

Which row of the table is correct for how and why the hot liquid will cool down in a metal flask?

	<b>How</b>	<b>Why</b>
<b>A</b>	more slowly	because metal is a poorer heat conductor than glass
<b>B</b>	more slowly	because more radiation is reflected back
<b>C</b>	more quickly	because metal does not keep such a good vacuum
<b>D</b>	more quickly	because metal is a better heat conductor than glass

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**QUESTION SIX**

You may find the following formula useful when answering this question.

$$\begin{array}{ccccccc} \text{energy transferred} & = & \text{power} & \times & \text{time} \\ \text{(kilowatt-hour, kWh)} & & \text{(kilowatt, kW)} & & \text{(hour, h)} \end{array}$$

The diagram shows an electricity meter reading on two different dates.

7	2	3	4
---	---	---	---

1<sup>st</sup> April 2005

8	4	6	8
---	---	---	---

1<sup>st</sup> July 2005

- 6.1** How many Units were used between 1<sup>st</sup> April and 1<sup>st</sup> July 2005?
- A 34  
B 234  
C 1000  
D 1234
- 6.2** What else would you need to know to work out the cost of the electricity used between these dates?
- A The cost of one Unit  
B The maximum current in amps  
C The time between the readings  
D The voltage of the supply

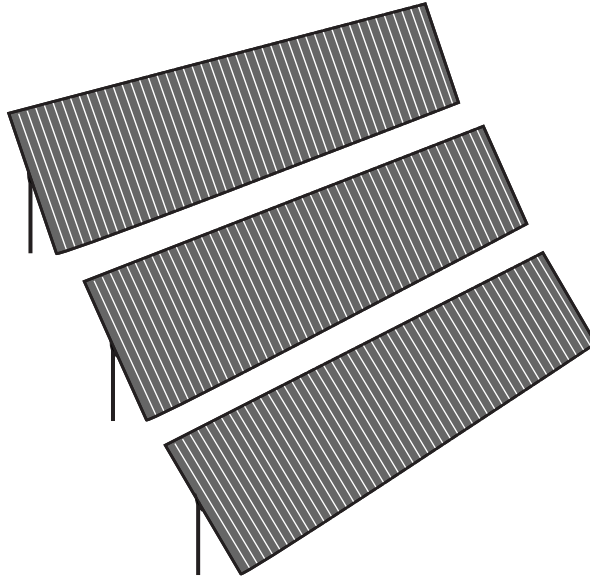
- 6.3** What is measured by the Units shown on the meter?
- A** The amount of energy used
  - B** The number of electrons that have passed through
  - C** The power of the appliances used
  - D** The time for which the supply has been used
- 6.4** Which of the following would use one Unit of electricity?
- A** A 1 kilowatt heater switched on for 1 hour
  - B** A 1 kilowatt heater switched on for 1 second
  - C** A 100 watt light bulb switched on for 10 minutes
  - D** A 1 watt indicator lamp switched on for 1 second

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**QUESTION SEVEN**

The drawing shows an array of solar cells.



When it is sunny, the array produces between 1 kW and 4 kW of electricity. It can provide 7500 kWh per year.

**7.1** The words *between 1 kW and 4 kW* describe the . . . . .

- A efficiency.
- B energy output.
- C number of Units used.
- D power output.

**7.2** The value of *7500 kWh* gives the . . . . .

- A electrical energy output.
- B electrical power input.
- C electrical power output.
- D solar energy input.

**7.3** Solar cells transfer . . . . .

- A** electrical energy to light energy.
- B** electrical energy to thermal energy.
- C** light energy to electrical energy.
- D** thermal energy to light energy.

**7.4** A disadvantage of using solar cells is that . . . . .

- A** they are expensive to make.
- B** they can be used only in remote locations.
- C** they can be used only where very small amounts of electricity are needed.
- D** they produce a lot of noise.

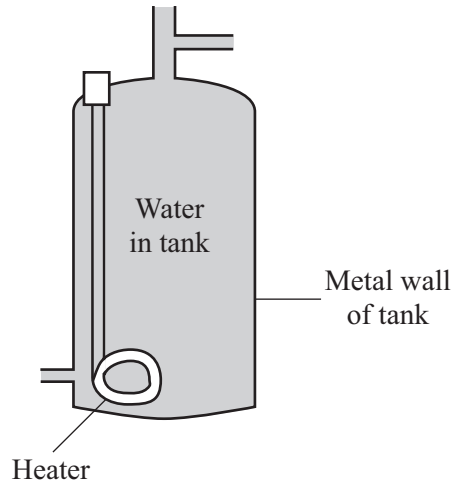
**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**QUESTION EIGHT**

Some homes have hot water tanks in which an electric heater is used to heat the water.

Some heat (thermal energy) is lost through the metal wall to the surroundings.



- 8.1** The energy spreads through the water by . . . . .
- A** heat rising.
  - B** heated water contracting and falling.
  - C** heated water expanding and rising.
  - D** the movement of free electrons.
- 8.2** The energy is transferred through the metal wall of the tank by . . . . .
- A** heated metal expanding and rising.
  - B** infra red waves passing through the metal.
  - C** the atoms gaining energy and moving faster through the metal.
  - D** the movement of free electrons.



**8.3** The metal wall of the tank transfers energy to the surroundings by . . . . .

- A heated air contracting and falling.
- B infra red waves passing through the air.
- C metal atoms gaining energy and escaping into the air.
- D the movement of free electrons.

**8.4** The air in contact with the metal walls . . . . .

- A contracts, and falls due to decreased density.
- B contracts, and falls due to increased density.
- C expands, and rises due to decreased density.
- D expands, and rises due to increased density.

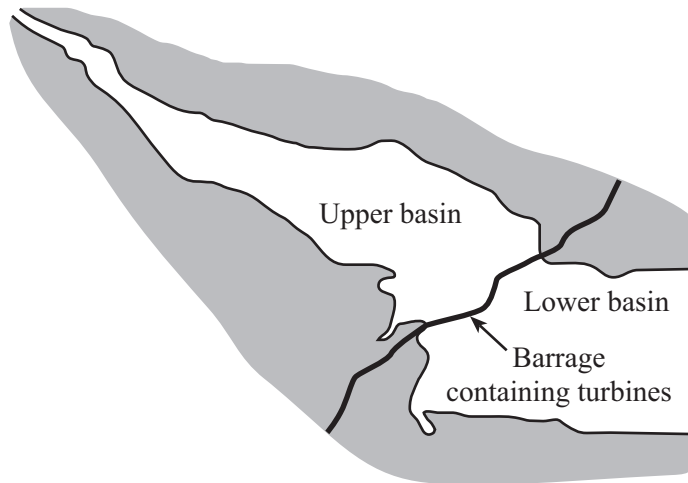
**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

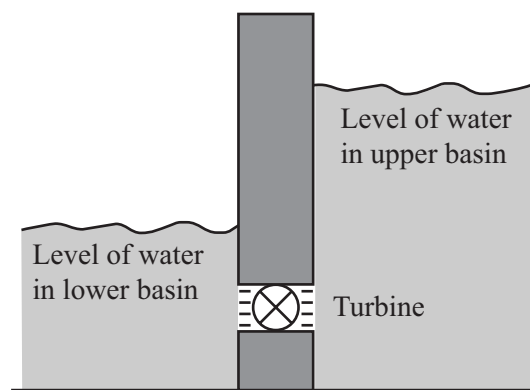
**QUESTION NINE**

The diagram shows a tidal barrage system used to generate electricity. Before the barrage was built, parts of the mud-flats on the estuary were repeatedly covered with sea water as the tide came in and went out again.

Wading birds feed on the mud-flats by eating organisms that live in the mud.



Section through barrage



**9.1** A student writes:

'In a tidal barrage system energy is wasted as

- heat
- light
- sound.'

How many of these three points are correct?

- A** None of them
- B** Only one of them
- C** Only two of them
- D** All of them

- 9.2** Which is the useful energy transfer as water flows from the upper basin through the turbine?
- A Electrical energy to gravitational potential energy
  - B Electrical energy to kinetic energy
  - C Gravitational potential energy to kinetic energy
  - D Kinetic energy to gravitational potential energy
- 9.3** Compared to a coal-fired power station with a similar generating capacity, a tidal barrage usually . . . . .
- A costs more to build.
  - B has a more concentrated energy supply.
  - C has higher fuel costs.
  - D produces more pollution.
- 9.4** One disadvantage of this tidal barrage is that . . . . .
- A it cannot be used in summer.
  - B it has low decommissioning costs.
  - C its output is constant.
  - D wading birds lose a food source.

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**QUESTION TEN**

Senegal is a poor, developing country. It has no large power stations. Small, local schemes are used for generating power. Solar cells are used to generate electricity for pumping water from wells in remote locations.

**10.1** What is the main reason for using solar cells in remote locations?

- A Solar cells are cheap to make
- B Solar cells provide a constant supply of electricity
- C The location is a long distance from other electricity supplies
- D The output from solar cells does not depend on the intensity of the light which falls on them

**10.2** Why does each location need a large number of solar cells?

- A The decommissioning costs are low
- B The energy supply is dilute
- C The installation costs are low
- D There will be less pollution

**10.3** An electrical pump is powered by solar cells. It pumps 4 litres of water to a height of 10 metres in 30 seconds.

1 litre of water has a weight of 10 newtons.

How much gravitational potential energy is gained by the water in 30 seconds?

- A 13.3 J
- B 40 J
- C 400 J
- D 12 000 J

**10.4** On a different day, the water from a well gains 20 joules of energy per second.

3200 watts of solar energy fall on the solar cells.

What is the efficiency of the system?

- A Less than 1 %
- B Between 1 % and 5 %
- C Between 5 % and 10 %
- D More than 10 %

**END OF TEST**