General Certificate of Secondary Education
November 2006

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

Thursday 23 November 2006   Morning Session

For this paper you must have:
- a black ball-point pen
- an objective test 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.
- Do all rough work in this book, **not** on your answer sheet.

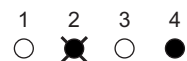**Instructions for recording answers**

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

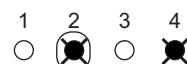- For each answer **completely fill in the circle** as shown:
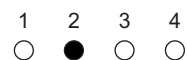
- Do **not** extend beyond the circles.

- 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.

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 words in the list with the numbers.

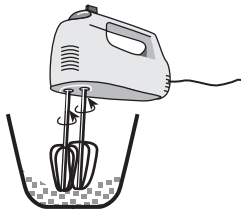Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

The devices shown transfer electrical energy in different ways.
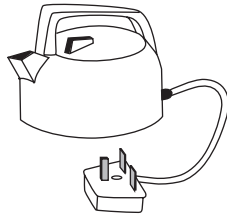
| **Food mixer** | **Kettle** | **Torch** | **Radio** |
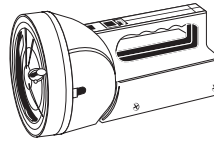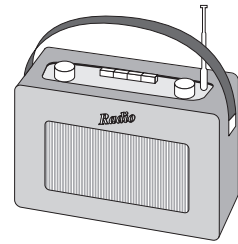
Match the devices with the numbers **1–4** in the table.

	Designed to transfer electrical energy as
1	heat
2	light
3	movement
4	sound

QUESTION TWO

A gas fire transfers energy to a room in various ways.

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

conduction

currents

radiation

reflection

Black surface
transfers heat
well by . . . **1** . . . .

The curved surface is shiny and
changes the direction of the heat
by . . . **2** . . . .

The heater is made of metal
which transfers heat well by
. . . **3** . . . .

Hot air rises through the heater by convection . . . **4** . . . .
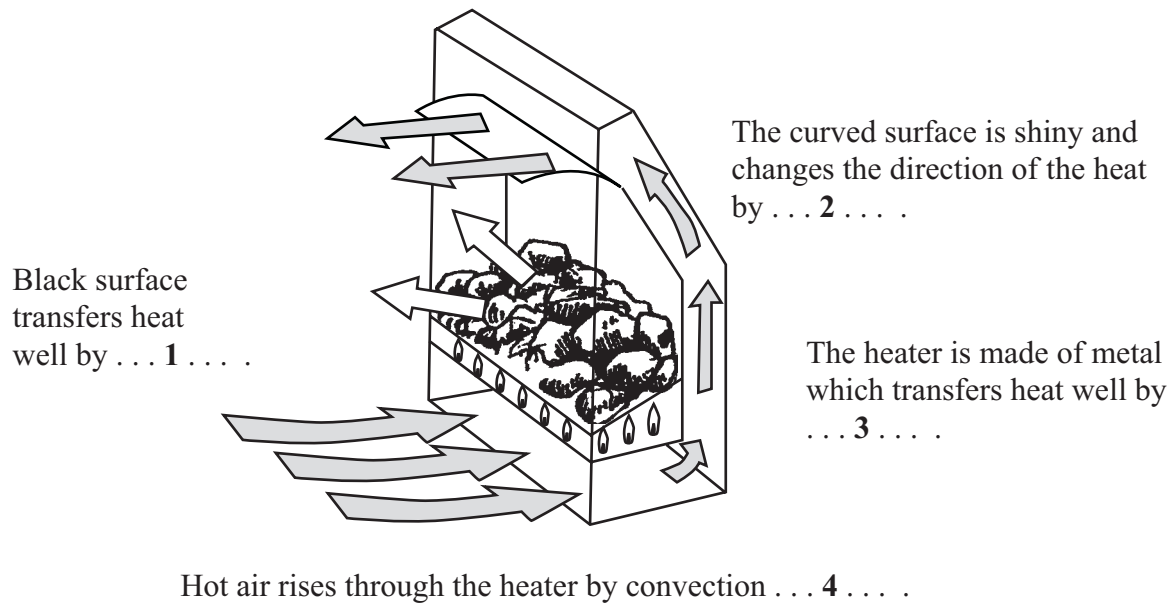
Turn over for the next question

QUESTION THREE

Generators produce electricity. They are driven by turbines.

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

     geothermal schemes

     hydroelectric schemes

     solar cells

     wind farms

. . . **1** . . . use moving air to drive the turbines.

. . . **2** . . . use water flowing down a hillside to drive the turbines.

. . . **3** . . . use steam from below the Earth's surface to drive the turbines.

. . . **4** . . . produce electricity without using turbines or generators.

QUESTION FOUR

The various methods of producing electricity affect the environment in different ways.

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

     fossil fuels

     hydroelectric schemes

     nuclear fuels

     wind farms

Polluting gases are released into the air by using . . . **1** . . . .
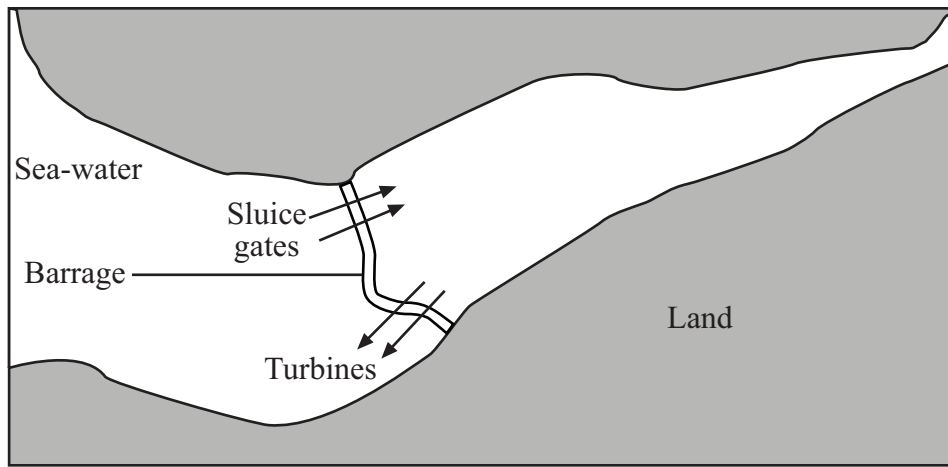
Upland river valleys are dammed when building . . . **2** . . . .

Noise and visual pollution of hills and coasts can be caused by . . . **3** . . . .

Dangerous radioactive waste is produced by using . . . **4** . . . .

QUESTION FIVE

The map shows a tidal barrage across an estuary.

Match statements from the list with the boxes **1–4** in the flow chart, to explain how the barrage works.

electricity is generated

water flows through the sluice gates

water flows through the turbines

water is trapped behind the barrage

```
┌──────────────────────────┐
│    as the tide comes in   │
└──────────────────────────┘
              │
              ▼
         ┌─────────┐
         │    1    │
         └─────────┘
              │
              ▼
         ┌─────────┐
         │    2    │
         └─────────┘
              │
              ▼
┌──────────────────────────┐
│     as the tide goes out  │
└──────────────────────────┘
              │
              ▼
         ┌─────────┐
         │    3    │
         └─────────┘
              │
              ▼
         ┌─────────┐
         │    4    │
         └─────────┘
```
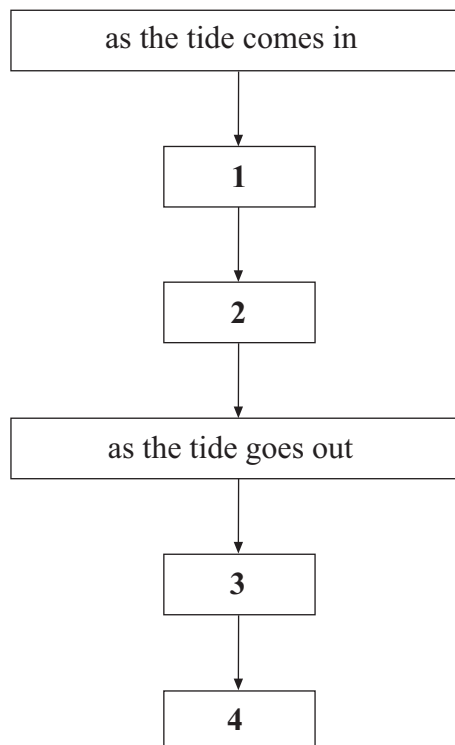
Turn over ▶

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 diagram shows a wind farm.
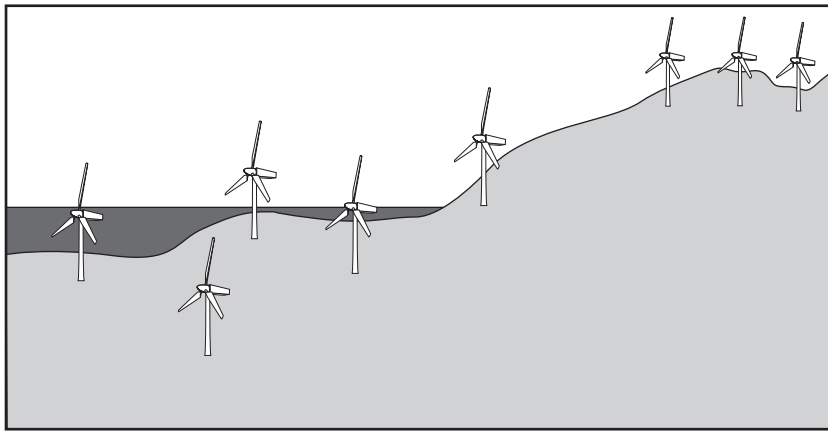
Which **two** statements about the use of wind farms are true?

Electricity can always be generated

No fuel is used

No sulphur dioxide is produced

Steam is produced

They cause no noise pollution

QUESTION SEVEN

Which **two** statements about hydroelectric schemes are true?

They are not very reliable

They are usually built in mountainous areas

They can be used in reverse to store energy from surplus electricity

They take a long time to start up

They use the power generated by waves

Turn over for the next question

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

Some power stations produce electricity from fuels. Usually, the fuels are burned to produce heat. Heat from the fuel is used to produce steam to drive turbines.
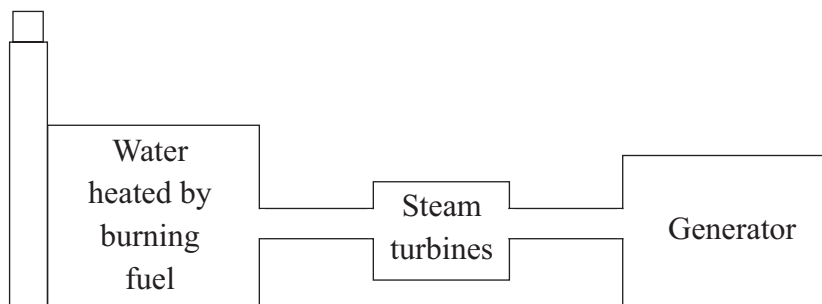
8.1 Which fuel does **not** have to be burned to produce heat?

A Coal

B Natural gas

C Oil

D Uranium

8.2 Which fuel makes least carbon dioxide per unit of energy produced?

A Coal

B Natural gas

C Oil

D Uranium

8.3 Governments are trying to reduce the amount of carbon dioxide released by power stations.

This is because carbon dioxide . . .

A   contains radioactive carbon.

B   increases global warming.

C   makes plants grow too fast.

D   makes the ocean acidic.

8.4 Usually, nuclear power stations are only shut down to service them.

What is the main reason for this?

A   It is dangerous to shut them down.

B   It takes a long time to start up a nuclear power station.

C   People are afraid of radiation from nuclear power stations.

D   Uranium is very expensive.

Turn over for the next question

Turn over ▶

QUESTION NINE

The diagram shows the ways in which heat can be lost from a house.

. . . . % through roof

35 % through
walls

10 % through
windows

15 % through
floor

15 % through gaps
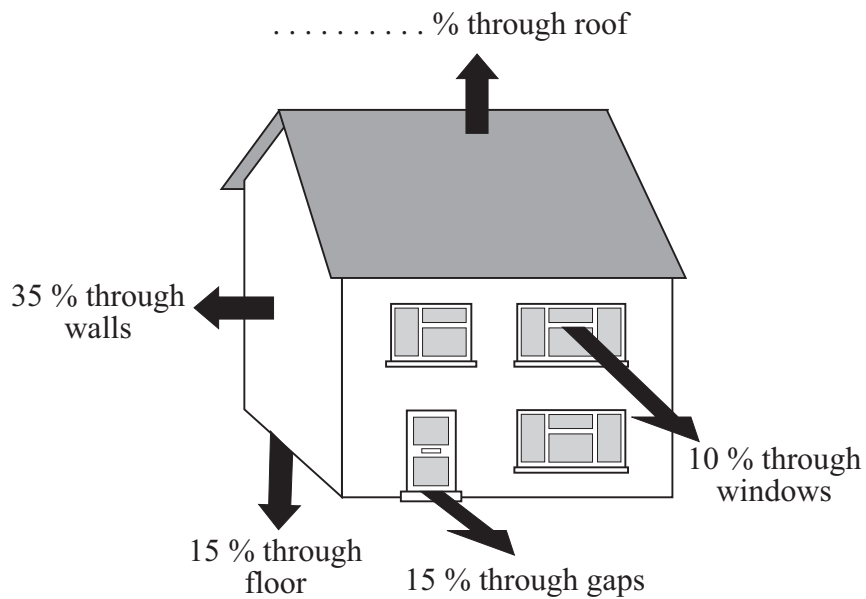
9.1   What percentage of heat is lost through the roof?

    A   15 %

    B   20 %

    C   25 %

    D   35 %

9.2   Which of the following might **increase** the amount of heat lost through the roof ?

    A   Fitting black roof tiles

    B   Fitting loft insulation

    C   Fitting thicker roof tiles

    D   Reducing the temperature in the house

9.3 Warm air rises to the top of the house by . . .

    A   conduction.

    B   convection.

    C   evaporation.

    D   radiation.

9.4 Heat is lost through the floor by . . .

    A   conduction.

    B   convection.

    C   evaporation.

    D   radiation.

Turn over for the next question

Turn over ▶

QUESTION TEN

The table gives information about ways of reducing energy loss from a house.

Method of reducing energy loss	Cost of fitting	Annual saving
Draught-proofing	£75	£75
Hot water tank jacket	£30	£20
Loft insulation	£300	£75
Temperature controls on radiators	£150	£30

10.1 Which method of reducing energy loss can stop a house becoming too warm?

    A   Draught-proofing

    B   Hot water tank jacket

    C   Loft insulation

    D   Temperature controls on radiators

10.2 Which method of reducing energy loss pays for itself in the shortest time?

    A   Draught-proofing

    B   Hot water tank jacket

    C   Loft insulation

    D   Temperature controls on radiators

10.3 Which method reduces energy loss by the smallest amount?

    A   Draught-proofing

    B   Hot water tank jacket

    C   Loft insulation

    D   Temperature controls on radiators

10.4 What is the payback time on loft insulation?

A $\frac{1}{4}$ year

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

C 2 years

D 4 years

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 words in the list with the numbers.

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

Mark your choices on the answer sheet.

QUESTION ONE

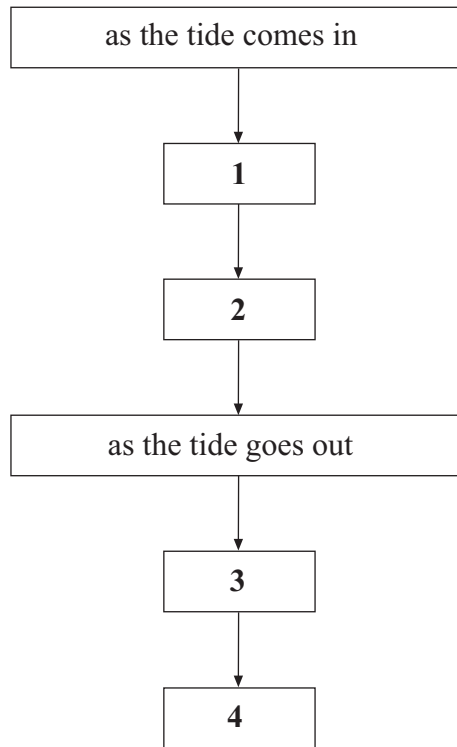The map shows a tidal barrage across an estuary.
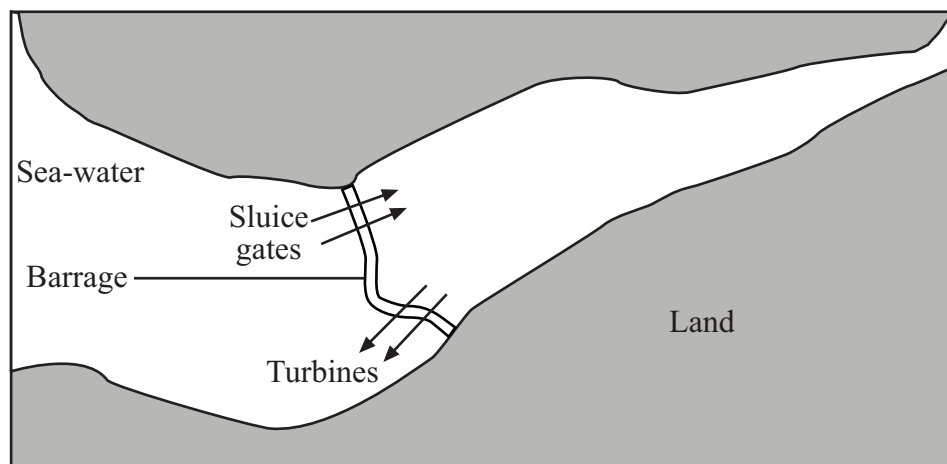
Match statements from the list with the boxes **1– 4** in the flow chart, to explain how the barrage works.

electricity is generated

water flows through the sluice gates

water flows through the turbines

water is trapped behind the barrage

```
┌─────────────────────────┐
│   as the tide comes in   │
└─────────────────────────┘
            │
            ▼
        ┌───────┐
        │   1   │
        └───────┘
            │
            ▼
        ┌───────┐
        │   2   │
        └───────┘
            │
            ▼
┌─────────────────────────┐
│   as the tide goes out   │
└─────────────────────────┘
            │
            ▼
        ┌───────┐
        │   3   │
        └───────┘
            │
            ▼
        ┌───────┐
        │   4   │
        └───────┘
```

Turn over for the next question

Turn over ▶

QUESTION TWO

Convection currents are formed in liquids which are heated.

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

decreases

increases

is unchanged

rises

When liquids are heated, the particles gain kinetic energy.

The space between the particles in the liquid . . . **1** . . . so the density of the liquid . . . **2** . . . .

The warm liquid . . . **3** . . . .

The total mass of the liquid . . . **4** . . . .

Turn over for the next question

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

Which **two** statements about hydroelectric schemes are true?

They are not very reliable

They are usually built in mountainous areas

They can be used in reverse to store energy from surplus electricity

They take a long time to start up

They use the power generated by waves

QUESTION FOUR

The drawing shows a high-jump athlete.

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

> **P** as the athlete falls, gravitational potential energy is transferred to kinetic energy
>
> **Q** as the athlete falls, kinetic energy is transferred to gravitational potential energy
>
> **R** the gravitational potential energy of the athlete in the position shown in the drawing is equal to the energy transferred as he rises above the ground
>
> **S** the kinetic energy of the athlete in the position shown in the drawing is equal to the energy transferred as he rises above the ground
>
> **T** when the athlete hits the ground, all the gravitational potential energy is regained

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

Some power stations produce electricity from fuels. Usually, the fuels are burned to produce heat. Heat from the fuel is used to produce steam to drive turbines.
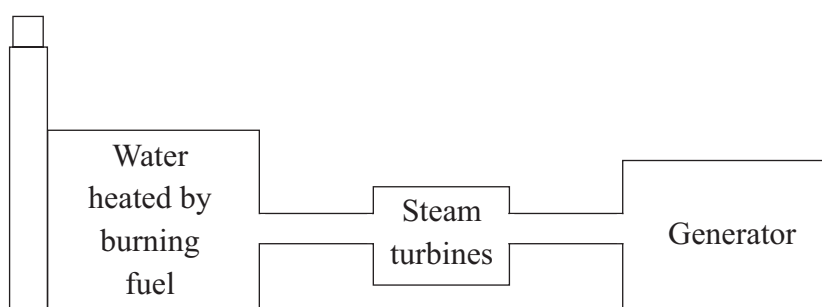
5.1   Which fuel does **not** have to be burned to produce heat?

A   Coal

B   Natural gas

C   Oil

D   Uranium

5.2   Which fuel makes least carbon dioxide per unit of energy produced?

A   Coal

B   Natural gas

C   Oil

D   Uranium

5.3   Governments are trying to reduce the amount of carbon dioxide released by power stations.

This is because carbon dioxide . . .

A   contains radioactive carbon.

B   increases global warming.

C   makes plants grow too fast.

D   makes the ocean acidic.

5.4   Usually, nuclear power stations are only shut down to service them.

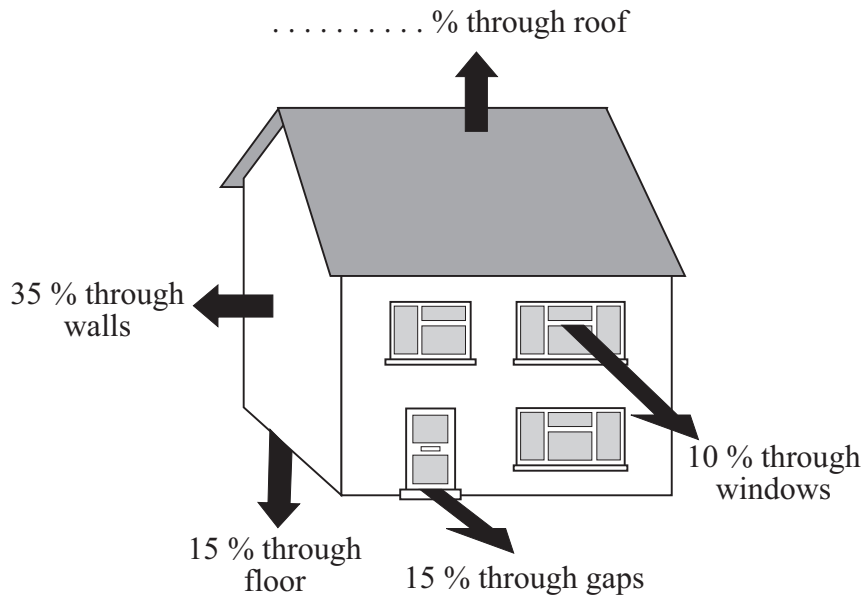What is the main reason for this?

A   It is dangerous to shut them down.

B   It takes a long time to start up a nuclear power station.

C   People are afraid of radiation from nuclear power stations.

D   Uranium is very expensive.

Turn over for the next question

QUESTION SIX

The diagram shows the ways in which heat can be lost from a house.

. . . . % through roof

35 % through
walls

10 % through
windows

15 % through
floor

15 % through gaps

6.1 What percentage of heat is lost through the roof ?

    A   15 %

    B   20 %

    C   25 %

    D   35 %

6.2 Which of the following might **increase** the amount of heat lost through the roof ?

    A   Fitting black roof tiles

    B   Fitting loft insulation

    C   Fitting thicker roof tiles

    D   Reducing the temperature in the house

6.3 Warm air rises to the top of the house by . . .

    A   conduction.

    B   convection.

    C   evaporation.

    D   radiation.

6.4 Heat is lost through the floor by . . .

    A   conduction.

    B   convection.

    C   evaporation.

    D   radiation.

Turn over for the next question

Turn over ▶

QUESTION SEVEN

The table gives information about ways of reducing energy loss from a house.

Method of reducing energy loss	Cost of fitting	Annual saving
Draught-proofing	£75	£75
Hot water tank jacket	£30	£20
Loft insulation	£300	£75
Temperature controls on radiators	£150	£30

7.1   Which method of reducing energy loss can stop a house becoming too warm?

    A   Draught-proofing

    B   Hot water tank jacket

    C   Loft insulation

    D   Temperature controls on radiators

7.2   Which method of reducing energy loss pays for itself in the shortest time?

    A   Draught-proofing

    B   Hot water tank jacket

    C   Loft insulation

    D   Temperature controls on radiators

7.3   Which method reduces energy loss by the smallest amount?

    A   Draught-proofing

    B   Hot water tank jacket

    C   Loft insulation

    D   Temperature controls on radiators

7.4 What is the payback time on loft insulation?

    A $\frac{1}{4}$ year

    B $\frac{1}{2}$ year
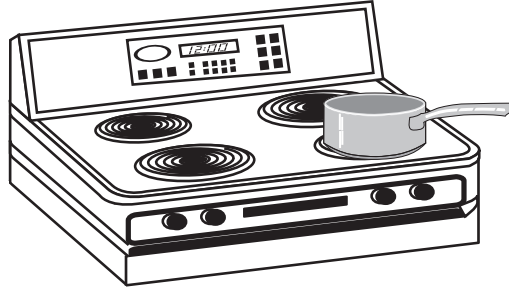
    C   2 years

    D   4 years

Turn over for the next question

Turn over ▶

QUESTION EIGHT

The drawing shows a pan on the top of a cooker. The pan contains soup.

Some heat is lost through the metal walls of the pan to the surroundings.

8.1   The energy spreads through the soup by . . .

   A   free electrons colliding with ions.

   B   heat rising.

   C   the soup contracting and falling as it is heated.

   D   the soup expanding and rising as it is heated.

8.2   The energy is transferred through the metal walls of the pan by . . .

   A   free electrons colliding with ions.

   B   heated metal expanding and rising.

   C   infra red waves passing through the metal.

   D   the atoms gaining energy and moving faster through the metal.

8.3   The outer walls of the pan transfer energy to the surroundings by . . .

   A   free electrons colliding with ions.

   B   infra red waves passing through the air.

   C   metal atoms gaining energy and escaping into the air.

   D   the air contracting and falling as it is heated.

8.4   The air in contact with the outer walls of the pan . . .

    A   contracts and falls because of its decreased density.

    B   contracts and falls because of its increased density.

    C   expands and rises because of its decreased density.

    D   expands and rises because of its increased density.
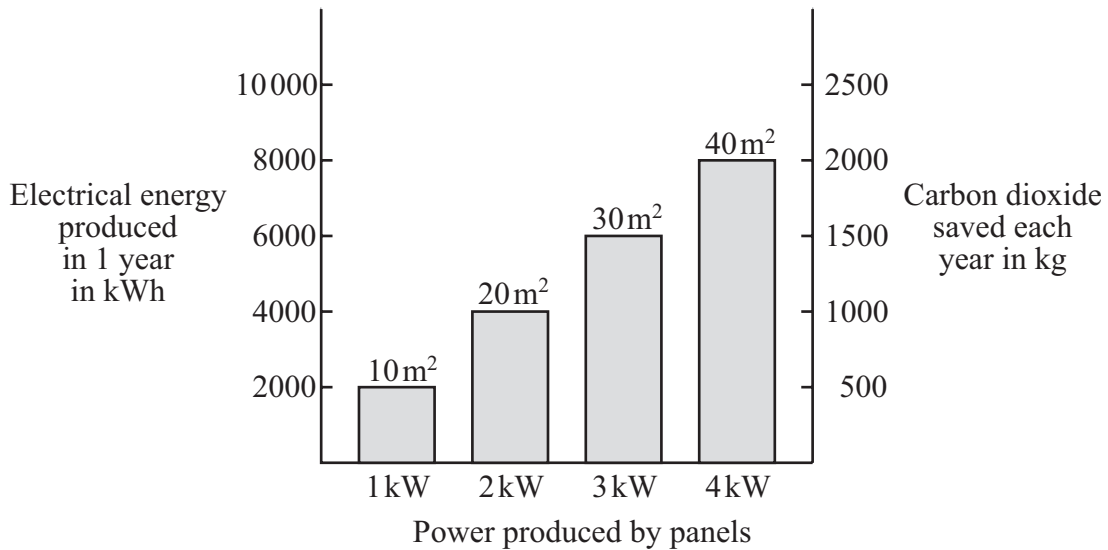
Turn over for the next question

Turn over ▶

QUESTION NINE

The chart gives information about solar cell panels used for producing electricity.

The chart shows:

- the area of the panels
- the power produced by the panels
- the electrical energy produced each year by using the panels
- the mass of carbon dioxide saved each year by using the panels.

9.1 What is the minimum area of panel that would be needed to power a 2.5 kW heater?

A $20\,m^2$

B $25\,m^2$

C $30\,m^2$

D $35\,m^2$

9.2 How much carbon dioxide could be saved each year by using panels with an area of $15\,m^2$?

A 500 kg

B 750 kg

C 1000 kg

D 1750 kg

9.3 What is the minimum area of panel that a household would need in order to produce 7000 kWh of electricity in a year?

A $20\,m^2$

B $25\,m^2$

C $30\,m^2$

D $35\,m^2$

9.4 The average cost of electricity each year for a household is £325. The householder thinks about installing solar cell panels. A suitable system will cost £12 900.

What is the approximate payback time?

A   32 years

B   36 years

C   40 years

D   48 years

Turn over for the next question

QUESTION TEN

In some power stations at night, electrical energy is used to pump water uphill into lakes. Later, the water is released and is used to drive turbines.

10.1 Electrical energy is used at night to pump water uphill because . . .

    A   at night the electricity is cheaper to produce.

    B   at night the demand for electricity is less, and the water stores energy until needed.

    C   it is more efficient to close down power stations at night.

    D   there is a high demand at night, and water can be released to meet the demand.

10.2 What is the maximum weight of water that can be pumped through a vertical height of 50 m by 2000 kJ of electrical energy?

    A   40 N

    B   400 N

    C   40 000 N

    D   100 000 N

10.3 Another power station releases 60 000 litres of water from a lake 40 m above the turbine.

One litre of water weighs 10 N.

What is the kinetic energy of the water when it reaches the turbine?

    A   1500 J

    B   15 000 J

    C   2 400 000 J

    D   24 000 000 J

10.4 The calculation in 10.3 is correct only if . . .

    A   the generator is considered to be 100 % efficient.

    B   the turbine is considered to be 100 % efficient.

    C   we assume that no energy is wasted as the water falls down the hill.

    D   we assume that no energy is wasted when the water is pumped uphill.

<div align="center">

END OF TEST

</div>

There are no questions printed on this page