Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature							

General Certificate of Secondary Education
Spring 2004

ASSESSMENT and QUALIFICATIONS ALLIANCE

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

Wednesday 3 March 2004 Morning Session

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

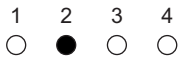
You may use a calculator.

Time allowed: 30 minutes

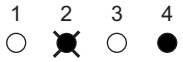
Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title "Energy" printed on it.
- Attempt **one Tier only**, **either** the Foundation Tier **or** 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

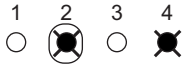
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 the words in the list with the numbers.

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

Mark your choices on the answer sheet.

QUESTION ONE

A sound system gets its energy from mains electricity.
The sound system transfers the electrical energy in different ways.

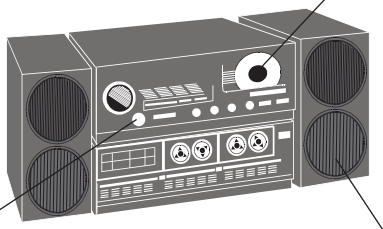
Match words from the list with the numbers **1–4** in the sentences.

heat (thermal energy)

light

movement (kinetic energy)

sound



An electric motor makes the CD go round. The motor transfers energy mainly as . . . . . **2** . . . . . .

The "power on" indicator transfers energy as . . . . . **1** . . . . . .

The loudspeakers are designed to transfer energy as . . . . . **3** . . . . . .

When the sound system is on it becomes warm. This is because some energy is transferred as . . . . . **4** . . . . . .

QUESTION TWO

A heater transfers energy to a room in various ways.

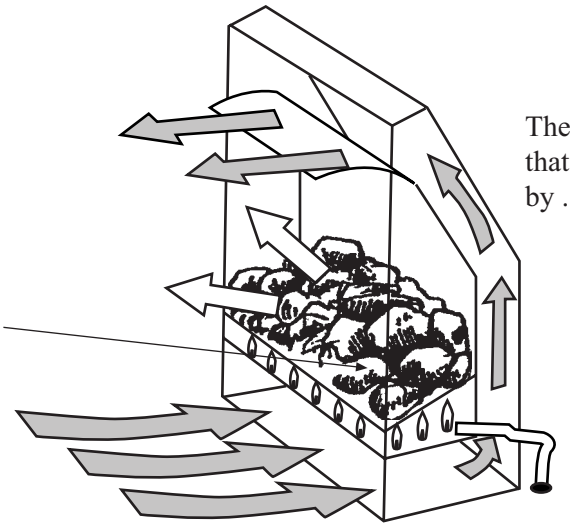
Match words from the list with the numbers **1–4** in the sentences.

conduction

convection

radiation

reflection



The curved surface is made shiny so that it changes the direction of the heat by . . . . . **2** . . . . . .

Black "fuel effect" lumps transfer heat well by . . . . . **1** . . . . . .

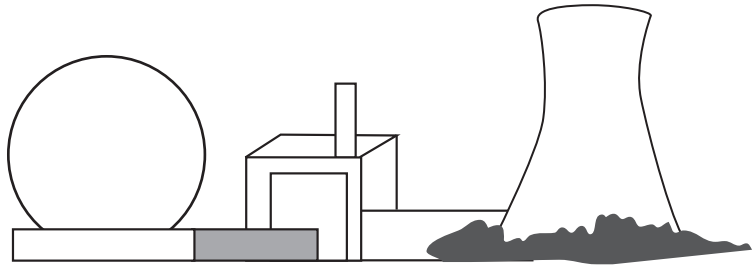
The heater is made of metal so that it transfers heat well by . . . . . **3** . . . . . .

Hot air rises through the heater by . . . . . **4** . . . . . currents.

TURN OVER FOR THE NEXT QUESTION

QUESTION THREE

The diagram shows a nuclear power station.



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

generator

steam

turbine

uranium

The energy source for this power station is . . . . . **1** . . . . . .

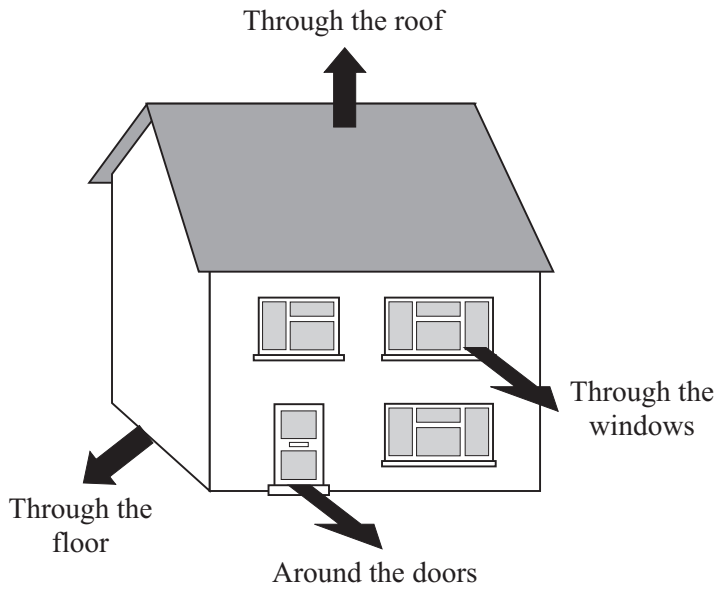
The reactor gets very hot and the energy is used to heat water to make . . . . . **2** . . . . . .

This then drives a . . . . . **3** . . . . . .

The electricity is produced by a . . . . . **4** . . . . . .

QUESTION FOUR

Heat escapes from houses in many ways. The diagram shows four of these ways.



People use various products to try to reduce the heat loss.

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

double glazing

draught excluder

fibreglass insulation

thick carpet

Product used to reduce heat loss	Where heat loss is reduced
1	around the doors
2	through the roof
3	through the floor
4	through the windows

QUESTION FIVE

Different types of power station affect the environment in different ways.

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

may cover farmland and forest with water

often on hills and can be unsightly

produces harmful waste gases

produces radioactive waste

Effect on the environment	Type of power station
1	coal-fired
2	hydroelectric
3	nuclear
4	wind farm

SECTION B

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

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

Do **not** choose more than two.

Make your choices on the answer sheet.

QUESTION SIX

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

$$\text{efficiency} = \frac{\text{useful energy transferred by device}}{\text{total energy supplied to device}}$$

$$\text{power (watt, w)} = \frac{\text{energy transferred (joule, J)}}{\text{time taken (second, s)}}$$

A lamp is switched on for two minutes.

In this time the lamp uses 12 000 J of energy, and transfers 3000 J as light.

Which **two** of the following statements are correct?

the efficiency of the lamp is 0.25 (25 %)

the efficiency of the lamp is 0.75 (75 %)

the power of the lamp is 100 W

the power of the lamp is 9000 W

the power of the lamp is 12 000 W

QUESTION SEVEN

Solar cells produce electricity from the Sun's radiation.

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

P **electricity from solar cells is used to heat water in panels on house roofs**

Q **electricity from solar cells is more expensive than electricity from non-rechargeable batteries**

R **solar cells are often the best source of electricity in remote locations**

S **solar cells are often used in calculators**

T **solar cells will not work on cloudy days**

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

Many different energy sources can be used to produce electricity.
Each energy source has advantages and disadvantages.

8.1 Which of the following energy sources is unreliable?

A Coal

B Oil

C Uranium

D Wind

8.2 Which type of power station would **not** contribute to global warming?

A A coal-fired power station

B A gas-fired power station

C A nuclear power station

D An oil-fired power station

8.3 Which type of power station involves the damming of upland river valleys?

A A geothermal power station

B A hydroelectric power station

C A tidal barrage

D A wind farm

8.4 Which type of power station can also be used to store energy from surplus electricity?

A A coal-fired power station

B A gas-fired power station

C A hydroelectric power station

D A nuclear power station

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

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

$$\text{efficiency} = \frac{\text{useful energy transferred by device}}{\text{total energy supplied to device}}$$

$$\text{power (watt, w)} = \frac{\text{energy transferred (joule, J)}}{\text{time taken (second, s)}}$$

The picture shows a hair dryer.

The electrical energy supplied to the hair dryer is transferred in different ways. Some of these energy transfers are useful, others are not.

9.1 Which line in the table is correct?

	Useful energy transfers in hair dryer	**Wasted energy transfers in hair dryer**
A	heat	kinetic and sound
B	heat and kinetic	heat and sound
C	heat and sound	kinetic
D	kinetic	heat and sound

9.2 What happens eventually to all the electrical energy supplied to the hair dryer?

A It fades away and finally disappears

B It gets so spread out it is difficult to use again

C It increases the greenhouse effect

D It is recycled

The hair dryer transfers 72 kJ of electrical energy every minute.
Every minute, 2 kJ are wasted.

9.3 What is the efficiency of the hair dryer?

A 0.36 (36 %)

B 0.70 (70 %)

C 0.97 (97 %)

D 1.03 (103 %)

9.4 What is the power of the hair dryer?

A 1.2 W

B 72 W

C 1.2 kW

D 72 kW

TURN OVER FOR THE NEXT QUESTION

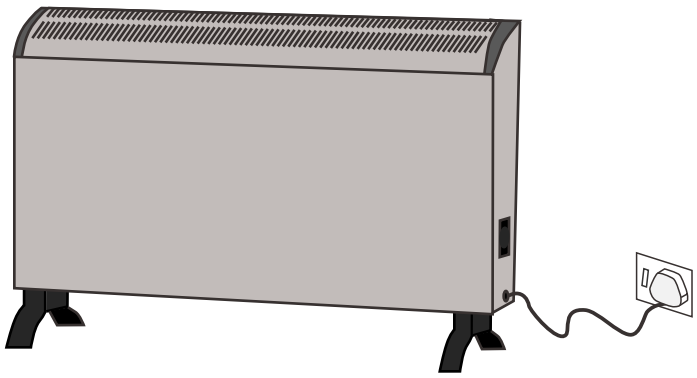
QUESTION TEN

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

energy transferred (kilowatt-hour, kWh) = power (kilowatt, kW) × time (hour, h)

total cost = number of Units × cost per Unit

The electrical heater shown in the diagram is rated at 3000 W.



10.1 During one day the heater was used for 6 hours.

How many Units of electricity were used?

A 18

B 300

C 500

D 18 000

10.2 Another heater is rated at 2.4 kW. It is used for 30 minutes.

How many Units of electricity are used?

A 1.2

B 7.2

C 72

D 4320

10.3 Each Unit of electricity costs 8 p.

How much does it cost to run a 100 W lamp for 40 hours?

A 20 p

B 32 p

C £ 3.20

D £ 320

10.4 The diagram shows the reading on a household electricity meter at the start of a day.

During the day the following appliances are used:

a 100 W lamp for 10 hours
a 1.5 kW vacuum cleaner for 2 hours
a 2 kW kettle for 0.5 hours
a 3 kW heater for 4 hours

What will the reading on the electricity meter be at the end of the day?

A 67511

B 68510

C 68544

D 69543

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

Different types of power station affect the environment in different ways.

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

may cover farmland and forest with water

often on hills and can be unsightly

produces harmful waste gases

produces radioactive waste

Effect on the environment	Type of power station
1	coal-fired
2	hydroelectric
3	nuclear
4	wind farm

QUESTION TWO

Convection currents are formed when liquids 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.

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QUESTION THREE

Solar cells produce electricity from the Sun's radiation.

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

P **electricity from solar cells is used to heat water in panels on house roofs**

Q **electricity from solar cells is more expensive than electricity from non-rechargeable batteries**

R **solar cells are often the best source of electricity in remote locations**

S **solar cells are often used in calculators**

T **solar cells will not work on cloudy days**

QUESTION FOUR

This question is about some of the energy sources that are used to generate electricity.

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

P **gas-fired power stations can be started up more quickly than coal-fired power stations**

Q **gas-fired power stations cause more atmospheric pollution than coal-fired power stations**

R **power stations using renewable energy sources can never provide a constant supply of electricity**

S **the capital cost of power stations using renewable energy sources is often higher than for gas-fired power stations**

T **the fuel for nuclear power stations costs more per Unit of electricity produced than the fuel for oil-fired power stations**

TURN OVER FOR THE NEXT QUESTION

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

Many different energy sources can be used to produce electricity.
Each energy source has advantages and disadvantages.

5.1 Which of the following energy sources is unreliable?

A Coal

B Oil

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D Wind

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C A nuclear power station

D An oil-fired power station

5.3 Which type of power station involves the damming of upland river valleys?

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B A hydroelectric power station

C A tidal barrage

D A wind farm

5.4 Which type of power station can also be used to store energy from surplus electricity?

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TURN OVER FOR THE NEXT QUESTION

QUESTION SIX

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

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6.1 Which line in the table is correct?

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C	heat and sound	kinetic
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A It fades away and finally disappears

B It gets so spread out it is difficult to use again

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Every minute, 2 kJ are wasted.

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B 0.70 (70 %)

C 0.97 (97 %)

D 1.03 (103 %)

6.4 What is the power of the hair dryer?

A 1.2 W

B 72 W

C 1.2 kW

D 72 kW

TURN OVER FOR THE NEXT QUESTION

QUESTION SEVEN

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

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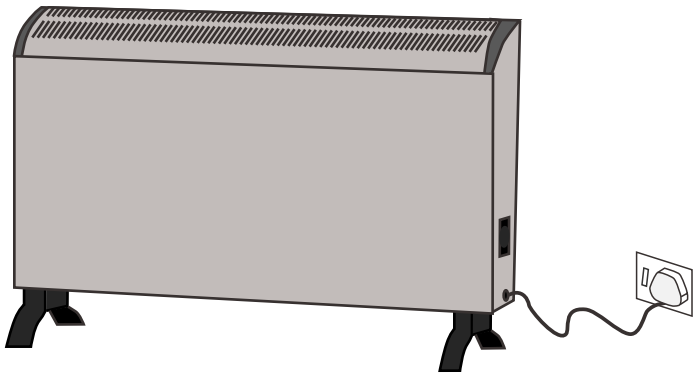
The electrical heater shown in the diagram is rated at 3000 W.



7.1 During one day the heater was used for 6 hours.

How many Units of electricity were used?

A 18

B 300

C 500

D 18 000

7.2 Another heater is rated at 2.4 kW. It is used for 30 minutes.

How many Units of electricity are used?

A 1.2

B 7.2

C 72

D 4320

7.3 Each Unit of electricity costs 8 p.

How much does it cost to run a 100 W lamp for 40 hours?

A 20 p

B 32 p

C £ 3.20

D £ 320

7.4 The diagram shows the reading on a household electricity meter at the start of a day.

During the day the following appliances are used:

a 100 W lamp for 10 hours
a 1.5 kW vacuum cleaner for 2 hours
a 2 kW kettle for 0.5 hours
a 3 kW heater for 4 hours

What will the reading on the electricity meter be at the end of the day?

A 67511

B 68510

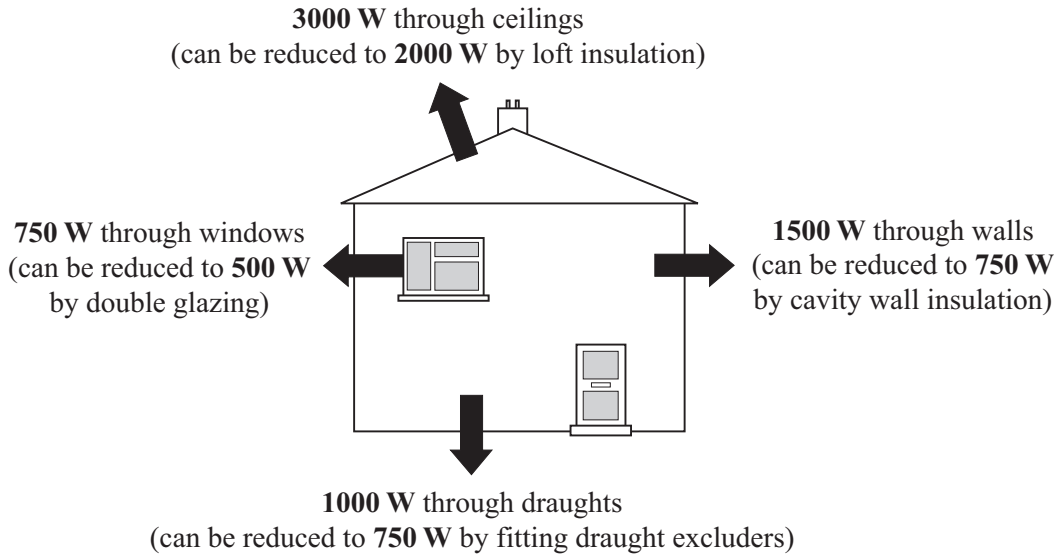
C 68544

D 69543

TURN OVER FOR THE NEXT QUESTION

QUESTION EIGHT

The diagram shows some of the ways that heat can be lost from the inside of a house. It also shows how these heat losses may be reduced.
The table shows the cost of reducing the heat loss, how much money can be saved and the pay-back time.



Way of reducing heat loss	Cost	Money saved per year	Pay-back time
cavity wall insulation	£675		5 years
double glazing	£2250	£45	50 years
draught excluders	£15	£45	
loft insulation	£360	£180	2 years

8.1 How much money is saved each year if cavity wall insulation is fitted?

A £135

B £670

C £680

D £3375

8.2 What is the pay-back time if draught excluders are fitted?

A 3 months

B 4 months

C 3 years

D 4 years

8.3 The house owner spends £375 on **two** ways of reducing heat loss.

By what percentage can they expect the total heat loss to be reduced?

A 20%

B 31%

C 44%

D 69%

8.4 Which way of reducing heat loss gives the greatest reduction as a percentage of the total heat loss?

A Cavity wall insulation

B Double glazing

C Draught excluders

D Loft insulation

QUESTION NINE

The table gives four different energy sources and the estimated costs, per Unit, of generating electricity for each one.

Use the information in the table to help you to answer the questions below.

Energy source	Building cost	Fuel cost	Operating cost	Decommissioning cost
Coal	2.0p	0.3p	0.7p	0.1p
Gas	2.3p	1.1p	0.3p	0.1p
Nuclear	4.2p	0.4p	0.7p	2.5p
Wind	2.8p	zero	0.9p	0.2p

9.1 Which of the following is the correct order (cheapest first) for the total cost of producing one Unit of electricity?

A Coal, gas, wind, nuclear

B Gas, coal, nuclear, wind

C Nuclear, wind, gas, coal

D Wind, gas, coal, nuclear

9.2 Considering only costs, which type of power station would be the best to run continuously to meet a steady demand?

A Coal

B Gas

C Nuclear

D Wind

9.3 Which type of power station is the best for meeting short surges in demand for electricity?

A Coal

B Gas

C Nuclear

D Wind

9.4 Electricity from wind farms costs more to produce than electricity from fossil fuel power stations. This is mainly because wind generators . . . . .

A are usually on hills and are unsightly.

B destroy farmland and forests, which may result in compensation payments to land owners.

C have higher de-commissioning costs.

D use a dilute energy source and therefore need hundreds of wind turbines to produce as much electricity as a fossil fuel power station.

TURN OVER FOR THE NEXT QUESTION

QUESTION TEN

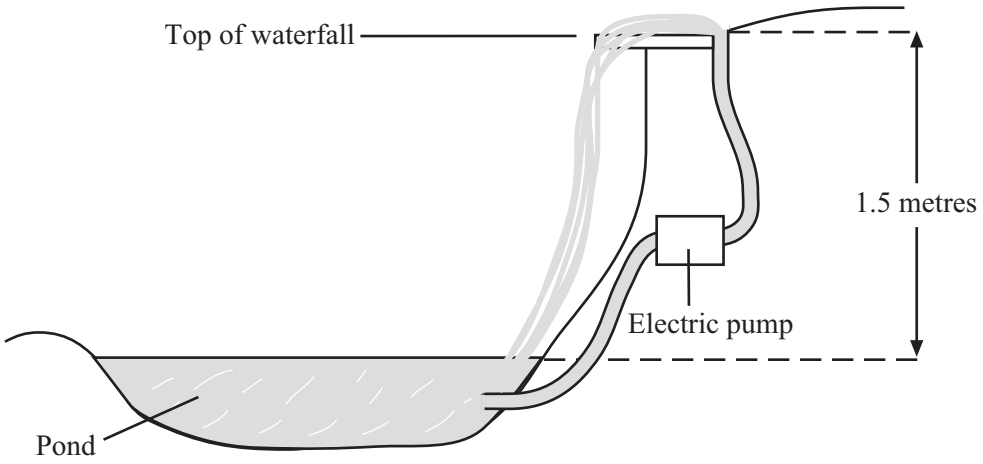
You may find the following formulae useful when answering this question.

$$\text{efficiency} = \frac{\text{useful energy transferred by device}}{\text{total energy supplied to device}}$$

$$\text{power (watt, W)} = \frac{\text{energy transferred (joule, J)}}{\text{time taken (second, s)}}$$

On Earth, 1 litre of water weighs 10 newtons.

The diagram shows a garden pond.
It has an electric pump which pumps water up to the top of a waterfall.
The top of the waterfall is 1.5 metres above the surface of the pond.



10.1 The pump has several settings. On one setting, it can deliver 600 litres of water to the top of the waterfall each hour.

How much gravitational potential energy would this amount of water gain on being lifted to the top of the waterfall?

A 9 J

B 150 J

C 900 J

D 9000 J

10.2 On a different setting, the water pumped to the top gains 120 joules. On this setting, the power delivered by the pump is 2 W.

How long does it take to pump the water to the top?

A 2 s

B 60 s

C 122 s

D 240 s

10.3 On a third setting, the power delivered is 10 W.

How many litres of water are raised to the top in one minute?

A 40

B 60

C 400

D 600

10.4 On one setting, the efficiency of the pump is 20 %.

How much electrical energy must be supplied to raise each litre of water to the top?

A 60 J

B 75 J

C 300 J

D 1200 J

END OF TEST

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