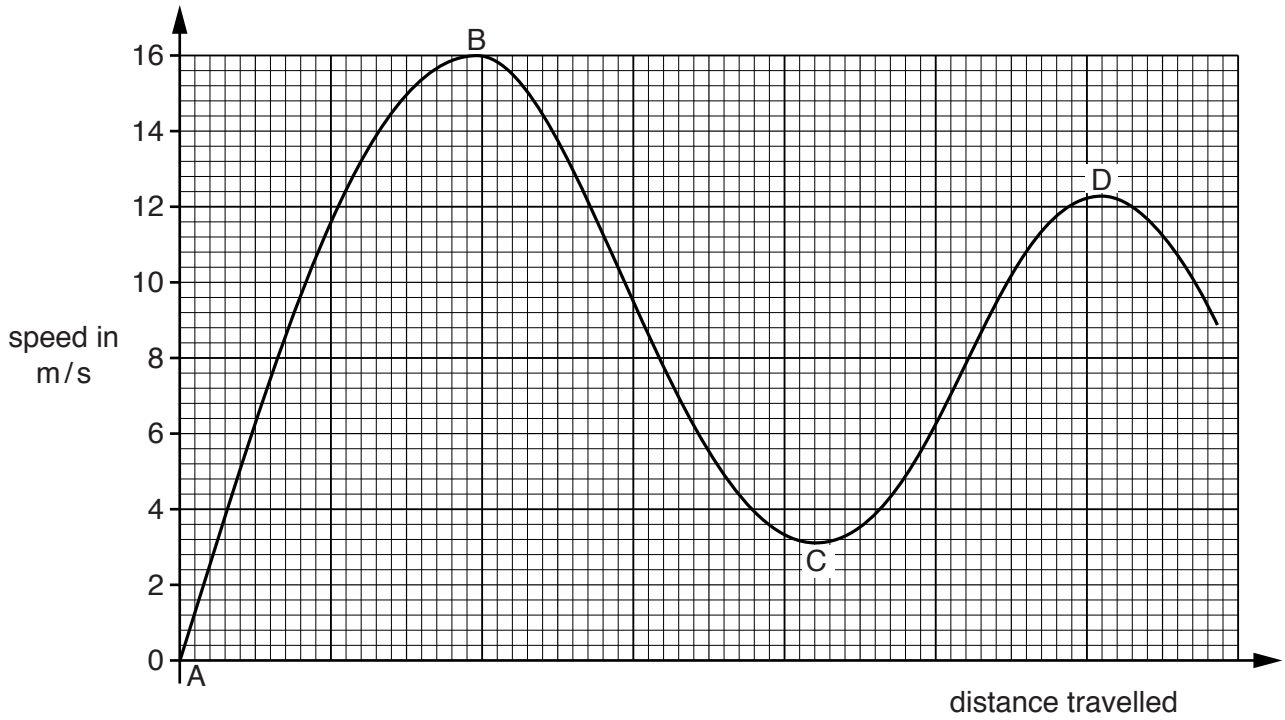
1 This question is about kinetic and gravitational potential energy.

Look at the graph.

It shows how the speed of a roller coaster car changes with the distance travelled along part of the track.
The roller coaster car starts from rest at the top of the track at **A**.
The car and its passengers have a total mass of 400 kg.



Describe how the kinetic energy and the gravitational potential energy of the car change in sections AB and BC of the journey, and calculate the difference in height of the roller coaster between A and B assuming no energy is lost.

The acceleration due to gravity is 10 m/s^2.

The quality of written communication will be assessed in your answer to this question.

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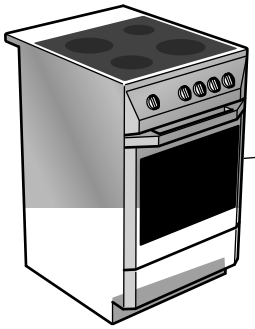
..... **[6]**

2 **(a** Damien wants to cook a curry he bought at the supermarket.

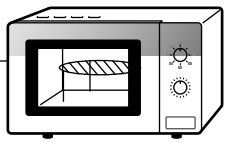
He looks at the label on the packaging of the meal.



Uses infrared radiation to cook the meal. Energy used = 5400 000 J

Place the meal in a glass dish.
Cook in either:
Conventional electric oven;
cook at 190 °C for 36 minutes.

or
Microwave oven;
cook for 6 minutes.



Uses microwave radiation to cook the meal. Energy used = 270 000 J

Explain in detail the mechanisms for both cooking methods and link these to the data for the energy used and cooking times needed.

The quality of written communication will be assessed in your answer to this question.

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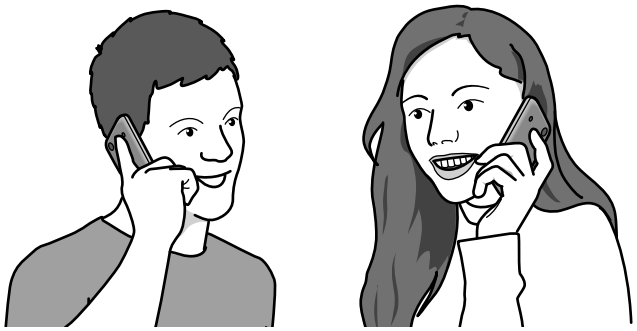
(b) Microwaves are also used for mobile phone messages.

Damien is worried about allowing his children to use mobile phones.



He finds evidence in some reports about possible dangers. Look at the notes he makes about the reports from three different years.

A: 2005 Studied phone use for 4000 people. Concluded that the risk of a cancerous tumour was not increased, at least in the first ten years.	**B**: 2007 Scientists exposed rat and human cells to microwave radiation and found this caused biological changes to the cells that could lead to tumours developing.	**C**: 2011 35 800 people aged 30 or over studied for 13 years of phone use. Study concluded that there was no increased risk of brain cancer or any other types of cancer.

Damien decided to allow his children to use mobile phones after considering the evidence from these reports.

Suggest reasons why he did this.

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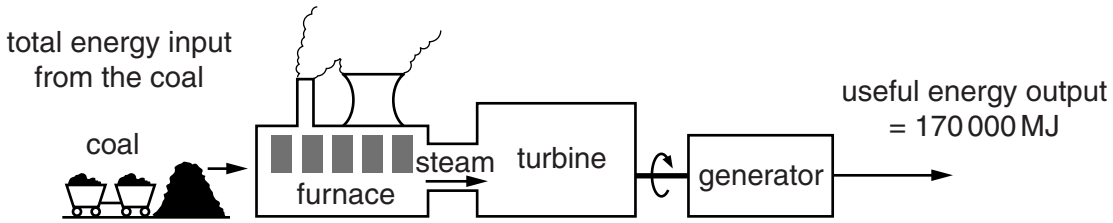
[Total: 8]

3 Electricity is generated in power stations.



(a) The efficiency of this power station is 34%.

Calculate the total energy input from the coal.

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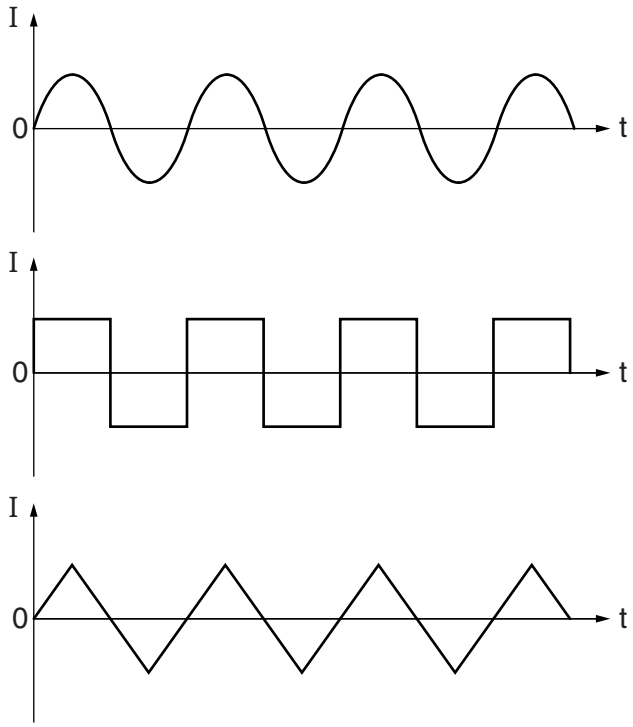
answer ..... MJ **[1]**

(b) The generator in the power station produces alternating current (AC).

Look at the three different current-time graphs.



Describe why all the graphs show alternating currents.

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..... **[1]**

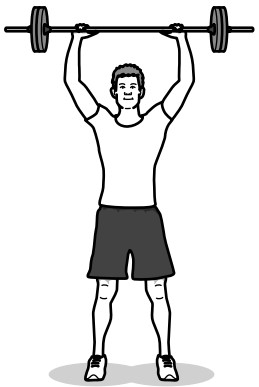
[Total: 2]

4 Hossein is a weightlifter.

His best lift in training is a bar with a mass of 250kg.

He does 5000 J of work on the bar with a mass of 250kg when he lifts it.

The gravitational field strength (g) on Earth is 10 N/kg.



Calculate the weight of this 250kg mass, and how high Hossein lifts the bar.

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weight = ... N

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height lifted = ... m

[3]

[Total: 3]

5 Dave experiments heating different materials.

(a) He needs to choose a heater to warm some water.

The table shows how much energy different heaters supply in 600 seconds.

Heater	Energy supplied in joules
A	5000
B	10 000
C	20 000
D	25 000
E	35 000

Dave needs to increase the temperature of 0.6 kg of water by 12 °C in 600 seconds.

Water has a specific heat capacity of 4200 J/kg °C.

Do a calculation to find out which heater Dave needs. Show your working.

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..... J

The heater Dave needs for this is ..... **[2]**

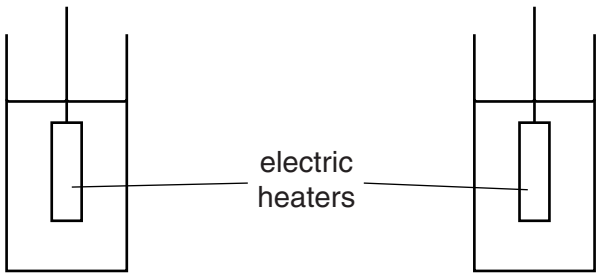
(b) Dave's teacher gives him two different liquids to boil.

They have different specific latent heats.

Specific latent heat of **water** = 2260 J/g
Specific latent heat of **ethanol** = 850 J/g

Unfortunately, he gets the two liquids confused. He cannot tell which liquid is which.

He heats up both liquids until they start to boil.



Dave then measures how much mass is lost from each liquid when he heats them for the same time.

Look at his results.

Liquid	Energy supplied for boiling in J	Mass of liquid lost in g
A	48 000	20
B	48 000	53

(i) Use a calculation to show which liquid is water.

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..... **[2]**

(ii) When liquids boil, energy is transferred but there is no temperature change.

Write down the name of **another** process in which this happens.

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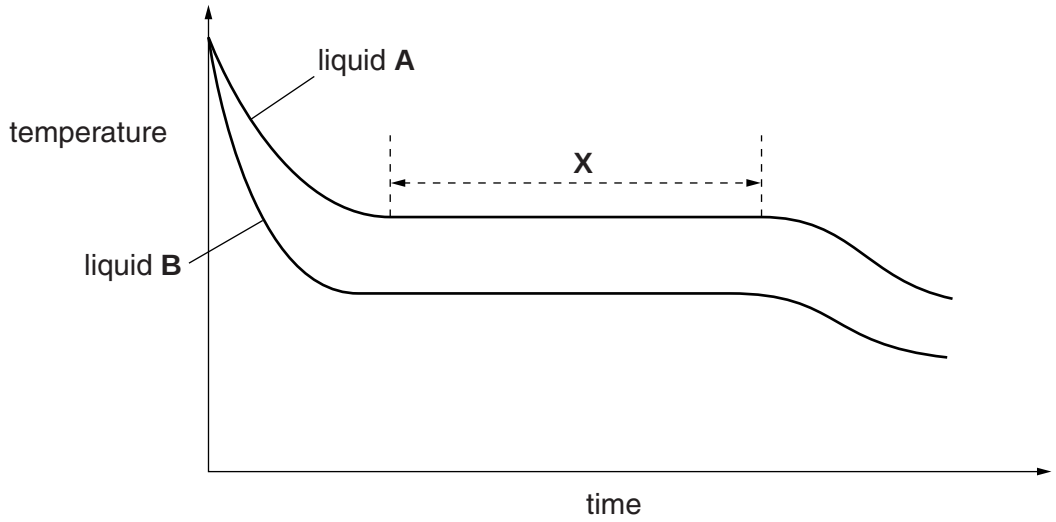
..... **[1]**

[Total: 5]

6 Amir investigated the cooling of two liquids.

Both liquids had a mass of 350 g.

Look at the graph of his results.



(a) Suggest why liquid **B** cools quicker than liquid **A** at the start of the experiment.

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..... **[1]**

(b) What is the direction of the energy flow and what is the effect on the surroundings?

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..... **[1]**

(c) **(i)** Calculate the energy that was transferred for liquid **A** in part **X** of the graph.

The specific latent heat of **A** is 200 000 J/kg.

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energy transferred ..... J **[2]**

(ii) Describe and explain what is happening during part **X** of the graph while this energy is being transferred.

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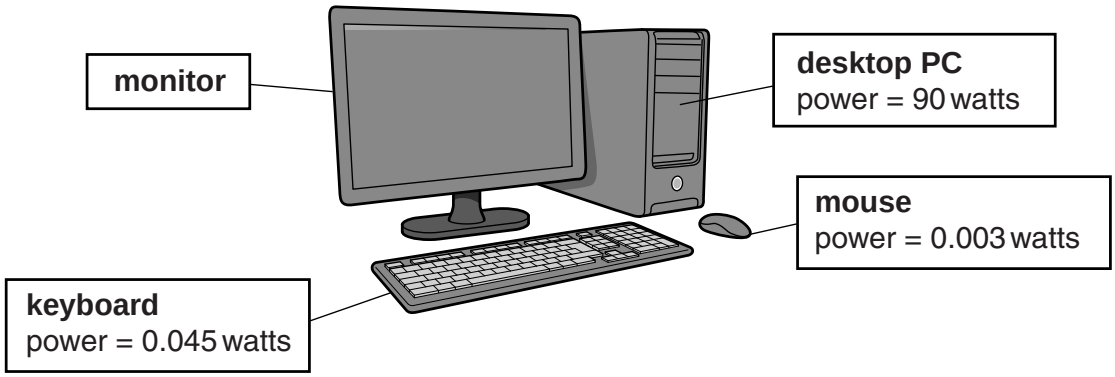
[Total: 6]

7 Kyle has a wireless computing system.

Look at the information in the diagram.



(a) The monitor plugs into a 230 V supply and uses a current of 0.5 A.

Calculate the power of the monitor in kilowatts.

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answer ..... kW **[2]**

(b) The energy supplied to the desktop pc in a day is 0.45 kilowatt hours.

How many hours does Kyle use the desktop PC for that day?

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answer ..... hours **[2]**

(c) The monitor and the desktop pc are connected to a 230 V supply.

The mouse and the keyboard use 3 V batteries.

Put the four parts of the system in order of the size of current used.

One has been done for you.

highest current .....

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keyboard

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lowest current ..... **[1]**

(d) Increasing the use of technology has increased energy consumption.

This may have contributed to global warming.

People have different views about reducing energy use.

Fatima thinks that it would help if everyone changed to using low energy light bulbs.

Claire thinks we could all reduce energy use by walking instead of driving cars.

Analyse these views and discuss how effective they could be for reducing global warming.

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..... **[2]**

[Total: 7]

8 Trevor wants to buy a new car.

The salesperson at his local garage gives him a brochure with information about some cars.

He looks at the information about five cars **V**, **W, X, Y** and **Z**.

car	engine size / capacity in cm^3	top speed in km per hour	time to accelerate from 0–90 km/hr in seconds	fuel consumption in kilometres per litre	CO_2 emissions in grams per kilometre	noise level in decibels
V	1800	201	5.0	16.9	170	72.9
W	1400	177	7.4	17.3	165	71.3
X	1600	193	6.2	16.1	169	71.5
Y	1000	145	9.3	18.5	132	69.8
Z	1200	171	7.2	19.2		71.0

Trevor wants to buy the car that is most economical and does the least harm to the environment.

He talks to the salesperson.

(a) Explain how Trevor has misinterpreted the information and suggest, with reasons, which car he should buy to meet his requirements.

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..... **[3]**

(b) (i) Trevor test drives one of the cars. It has a weight of 12 000 N.

He drives with a net driving force of 500 N for a distance of 850 m during part of the drive.

This produces the maximum engine power and takes a time of 35 seconds.

Calculate the **power**.

Write your answer in kilowatts, **rounded** to the nearest kilowatt.

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answer ..... kW **[2]**

(ii) This represents the highest power of all of the 5 cars.

Use the information in the table to explain which car Trevor test drove.

Assume the mass of each car increases with engine size.

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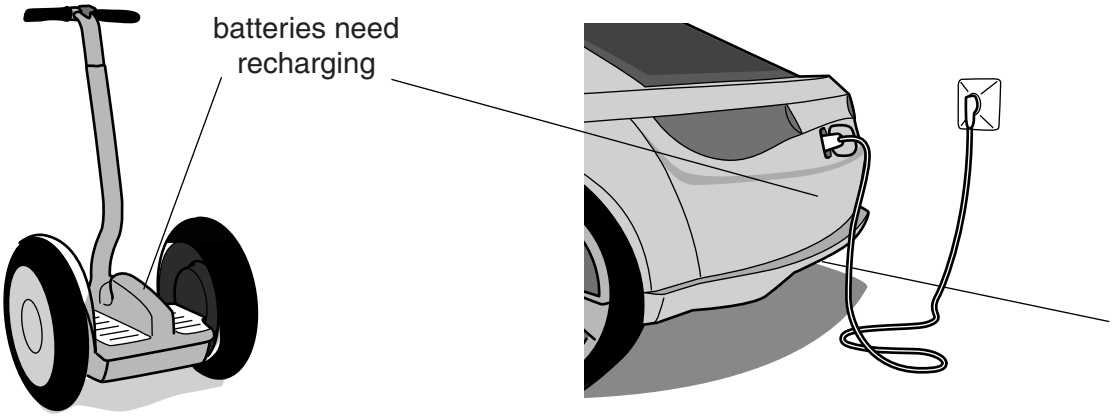
(c) Trevor's friend John lives in the centre of a city.

John is considering buying an electric vehicle to drive on the inner city roads.

Look at the two examples of electric vehicles.



Electric powered vehicles could increasingly replace petrol driven cars.

Discuss the implications for **drivers** and **pedestrians** if this happens.

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[Total: 8]