

Friday 20 January 2012 – Morning

**GCSE GATEWAY SCIENCE
PHYSICS B**

B751/02 Physics modules P1, P2, P3 (Higher Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 1 hour 15 minutes



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- A list of equations can be found on page 2.
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **75**.
- This document consists of **24** pages. Any blank pages are indicated.

EQUATIONS

$$\text{energy} = \text{mass} \times \text{specific heat capacity} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{efficiency} = \frac{\text{useful energy output} (\times 100\%)}{\text{total energy input}}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{distance} = \text{average speed} \times \text{time}$$

$$s = \frac{(u + v)}{2} \times t$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{power} = \text{force} \times \text{speed}$$

$$\text{KE} = \frac{1}{2}mv^2$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{force} = \frac{\text{change in momentum}}{\text{time}}$$

$$\text{GPE} = mgh$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

$$m_1u_1 + m_2u_2 = (m_1 + m_2)v$$

$$\text{refractive index} = \frac{\text{speed of light in vacuum}}{\text{speed of light in medium}}$$

$$\text{magnification} = \frac{\text{image size}}{\text{object size}}$$

$$l_e = l_b + l_c$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} =$$

$$\frac{\text{number of primary turns}}{\text{number of secondary turns}}$$

$$\text{power loss} = (\text{current})^2 \times \text{resistance}$$

$$V_p I_p = V_s I_s$$

Answer **all** the questions.

Section A – Module P1

1 Phone masts send and receive microwave signals for mobile phones.



(a) Some people are concerned about having a phone mast near to their house.

Suggest whether or not having a mast near someone's house can be dangerous. Explain your answer.

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..... [2]

(b) It is difficult to make conclusions about the danger of microwaves to people using mobile phones.

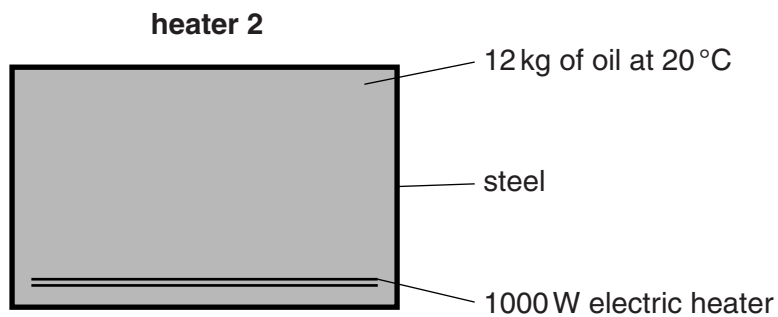
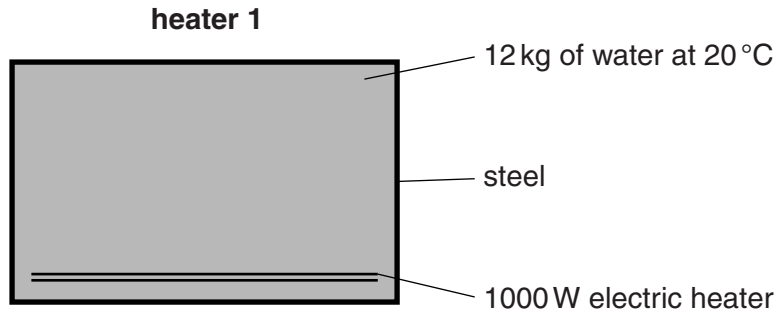
Suggest reasons why.

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..... [2]

[Total: 4]

(b) Bilhar has two types of heater. They are filled with different liquids.

Look at the diagrams of Bilhar's heaters.



Heater 1 is filled with water. Heater 2 is filled with oil.

(i) The water in heater 1 is at 20°C.

Bilhar switches on heater 1. The electric heater heats the water.

The heater supplies 2 100 000 J of energy to the 12 kg of water.

The specific heat capacity of water is 4200 J/kg°C.

Calculate the maximum **temperature** of the water.

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answer °C [3]

(ii) It is unlikely the water will get to this temperature. Suggest why.

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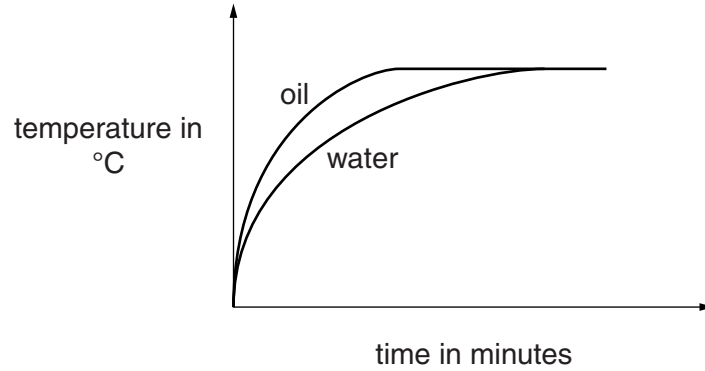
 [1]

(c) Bilhar switches on heater 2.

The specific heat capacity of oil is $1670 \text{ J/kg}^\circ\text{C}$.

The liquids in the two heaters are heated to a temperature of 50°C .

Look at the graph of the temperatures of the liquids in the heaters.



Water filled heaters are more useful for heating Bilhar's house.

Use the graph to help you explain why.

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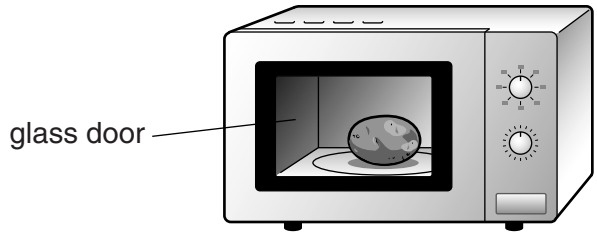
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..... [3]

[Total: 13]

3 Sam puts a potato into her microwave oven.



She heats the potato for 8 minutes.

It is cooked through to the centre.

Sam also uses a **convection** oven to cook a potato of the same size.

This method, using infrared radiation, takes more than one hour to cook potatoes through to the centre.

Sam's microwave oven cooks food differently and wastes less energy than her convection oven.

Explain why.

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..... [3]

[Total: 3]

4 Light waves carry information along optical fibres.

(a) How does light travel along the length of an optical fibre?

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..... [1]

(b) Information can also be carried along copper wires.

Using optical fibres can be a **better** way to carry information.

Suggest reasons why.

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..... [2]

(c) A laser produces a beam of light.

How is a beam of light from a laser different from a beam of light from a torch?

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..... [2]

[Total: 5]

Section B – Module P2

5 Amrit spends a lot of money on her electricity bills. One of her appliances is an iron.

(a) Amrit uses the iron for 0.5 hours. Its power is 1500W. Electricity costs 18 pence per unit.

Calculate the number of kilowatt hours used by the iron and how much this will cost.

.....
.....

number of kWh =

.....

cost of using the iron = pence [3]

(b) Amrit has a fan heater. It has a power rating of 1955W and a voltage of 230V.

The fuse in the plug states a 'maximum current of 13A'.

Amrit wants to find out whether the fuse is suitable.

Calculate the current in the fan heater.

.....
.....

answer A [2]

(c) Amrit decides to change to **off-peak** electricity.

Off-peak electricity has advantages for producers and consumers.

(i) Write down one advantage and one disadvantage of off-peak electricity **for Amrit**.

advantage.....

disadvantage..... [2]

(ii) Power stations produce electricity 24 hours a day.

Producers sell off-peak electricity. This increases their profit.

Explain how using more off-peak electricity can benefit **energy supply**.

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

[Total: 8]

Turn over

6 Most scientists agree that the greenhouse effect causes global warming.

However, other scientists disagree about the causes of global warming.

The changes in the climate that we've seen are due to a natural cycle. Humans are not to blame.



Global warming is caused by humans. We've increased the amount of CO₂ in the atmosphere.



(a) Suggest reasons why scientists may **disagree** on the **causes** of global warming.

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..... [2]

(b) Josh tries to explain what the greenhouse effect is.



Methane and carbon dioxide are the main greenhouse gases. They ‘trap’ heat below the atmosphere. It is something to do with the wavelengths of radiation but I am not sure what happens.

Explain in more detail the role of radiation in the greenhouse effect.



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

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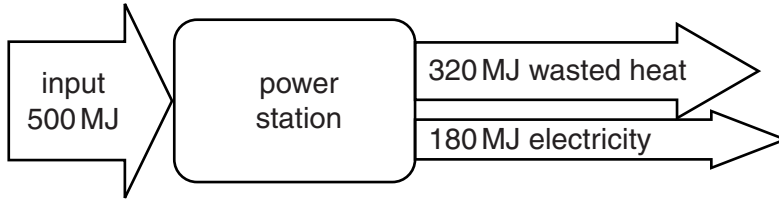
..... [6]

[Total: 8]

7 Electricity is generated in power stations from the energy stored in fuels.

Fossil fuel power stations burn coal, oil or gas.

Look at the energy diagram of a power station.



(a) Calculate the efficiency of the power station.

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answer [2]

(b) The power station engineer thinks the power station could be made more energy efficient without increasing the electrical efficiency.

Suggest how the efficiency of the power station could be increased, other than by generating more electricity.

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..... [2]

[Total: 4]

8 Nuclear radiation can be both useful and dangerous.

The three types of nuclear radiation are alpha, beta and gamma.

(a) Look at the table about nuclear radiation. It is incomplete.

Complete the table.

nuclear radiation	example of use	stopped by
alpha		a sheet of card
beta		
gamma	treating cancer	a few cm of lead

[3]

(b) Radioactive materials have to be disposed of safely.

Some high level nuclear waste from a power station is in liquid form.

The nuclear power company want to bury the liquid waste underground.

Explain the risks of doing this.

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..... [2]

[Total: 5]

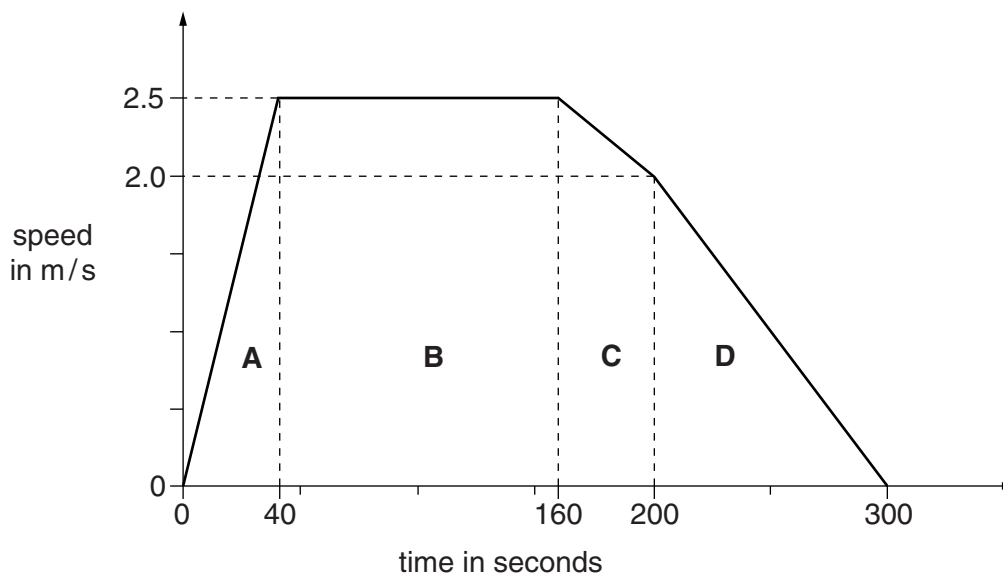
Section C – Module P3

9 Laura and Paul are learning about speed and distance in a science lesson.

Paul walks around the school sports field.

Laura calculates the speed for different parts of his walk.

She draws a speed-time graph.



(a) Laura thinks that Paul **accelerates** in part **A** but **decelerates** in part **C**, then decelerates **more rapidly** in part **D**.

Is Laura correct?

answer

Explain your answer using information from the graph.

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[2]

(b) (i) Calculate the **distance** travelled while Paul's speed is **increasing**.

Put a **ring** around the correct answer.

- 10 m 50 m 80 m 90 m 100 m 300 m

[1]

(ii) Paul walks a **total** distance of 540 m.

His **average** speed for the whole walk is 1.8 m/s.

He does a **longer** walk of 1.2 km at the **same** average speed.

Calculate the time for his longer walk.

Give your answer to **3** significant figures.

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answer s

[2]

[Total: 5]

10 A car manufacturer tests a car to find out its mean fuel consumption.

Six different drivers drove the car 700m in a test drive.

The car was identical apart from the differences shown in the table.

driver	car windows	roof box fitted to car?	fuel consumption in kilometres per litre	CO ₂ emissions in grams per kilometre
A	closed	x	15.5	150
B	closed	x	17	140
C	open	✓	12	180
D	open	x	16	155
E	closed	✓	14.5	165
F	closed	✓	15.0	160

(a) Calculate the **mean** fuel consumption for the car from these results.

.....

answer kilometres per litre [1]

(b) Look at the fuel consumption data in the table.

One of the test drives produced a value well below the mean compared to the others.

This is partly due to increased drag.

Which driver is this? Choose from **A, B, C, D, E** or **F**.

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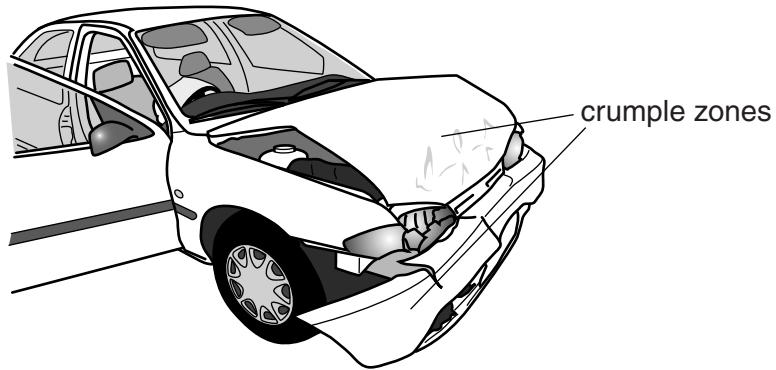
Identify what causes the increased drag **and** explain how this and **other** factors, lead to the poor fuel consumption.

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 [3]

[Total: 4]

11 Cars have many safety features such as crumple zones.



Crumple zones help to protect the occupants if a car is involved in a crash.

Car manufacturers continually try to improve safety features for drivers and passengers.

Explain in detail how crumple zones work and describe how manufacturers test crumple zones and use the results to improve future car design.



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

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[Total: 6]

12 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	136	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.

Car **X** has the best fuel consumption and is quiet and I like the performance figures for car **V**.



Trevor

I don't think either car is the best one for you. You're misinterpreting some of the information. I would suggest car



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.

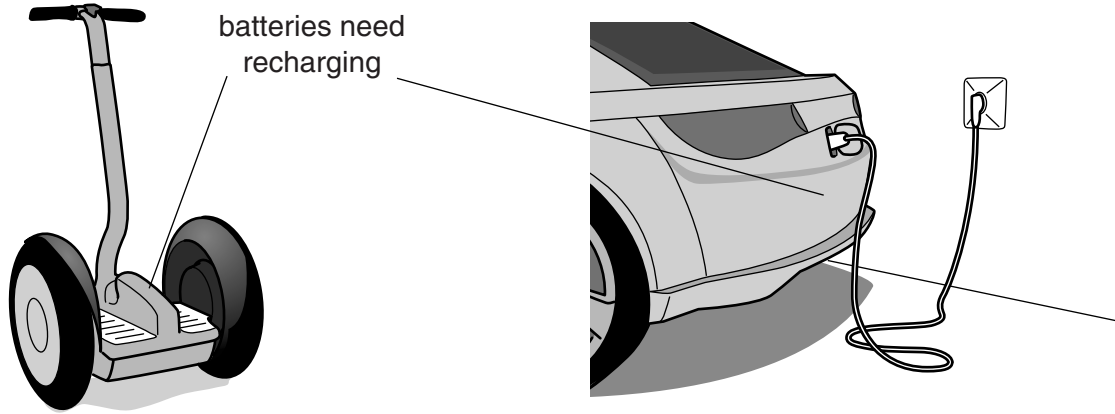
Assume the mass of each car increases with engine size.

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..... [1]

(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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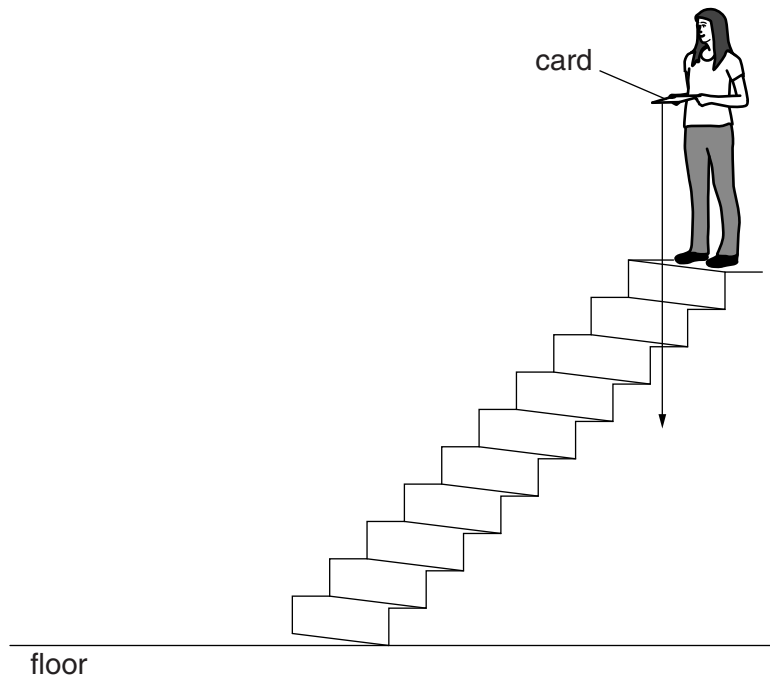
[Total: 8]

21
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TURN OVER FOR QUESTION 13
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13 Molly is investigating falling objects in a science lesson.

She drops a piece of thin card from the top of a staircase and measures the time it takes to fall to the floor. She then changes its shape and repeats the test.



Look at Molly's results.

thin card	shape of card that was dropped	description	mass in grams	time to fall in seconds
A		thin card sheet area exposed to air during fall = 1200cm^2	5.0	5.2
B		thin card sheet folded in half area exposed to air during fall = 600cm^2	5.0	3.8
C		card crushed into a ball shape area exposed to air during fall = 150cm^2	5.0	1.2

Put a tick (✓) in the box beside each correct statement.

statement	
all sheets of paper have the same drag force when accelerating	
the weight of each sheet = the drag force when they fall at terminal speed	
the time to fall is directly proportional to the exposed area	
drag on A > drag on B > drag on C when falling	
at terminal speed the loss of GPE increases the thermal energy of the surrounding air particles	

[2]

[Total: 2]

END OF QUESTION PAPER

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