OXFORD CAMBRIDGE AND RSA EXAMINATIONS

GCSE GATEWAY SCIENCE

B751/02

PHYSICS B

Physics modules P1, P2, P3

(Higher Tier)

TUESDAY 10 JUNE 2014: Afternoon

DURATION: 1 hour 15 minutes plus your additional time allowance

MODIFIED ENLARGED 24pt

Candidate forename		Candidate surname	

Centre number						Candidate number				

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)

READ INSTRUCTIONS OVERLEAF

DC (LK/SW) 3988915283 96508/1

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the boxes on the first page. 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).

INFORMATION FOR CANDIDATES

The quality of written communication is assessed in questions marked with a pencil ( ).

A list of equations can be found on pages 4–6.

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.

Any blank pages are indicated.

EQUATIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\text{GPE} = mgh$$

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

$$v = u + at$$

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

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

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

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

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

$$I_e = I_b + I_c$$

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

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

$$V_pI_p = V_sI_s$$

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Answer ALL the questions.

SECTION A – Module P1

1 Ultraviolet (UV) light comes from the Sun.
UV light is also used in sunbeds.

Many doctors are worried about the dangers to people who are exposed to UV light.
Skin cancer has been linked to UV light.

(a) One type of skin cancer is called malignant melanoma.
Look at the table opposite about patients that have this cancer.
It shows the percentage of malignant melanomas found in each body area.

Body area	Males	Females
Head and neck	23%	14%
Chest and back	41%	20%
Arms	18%	23%
Legs	13%	39%
Other	5%	4%

Tara looks at the information.
She suggests, 'Males have a higher percentage of malignant melanomas on their head and neck because, on average, males have shorter hair than females.'

Explain how shorter hair may increase the risk of malignant melanomas.

_____

_____ **[1]**

(b) Scientists are unsure whether exposure to the sun or sunbeds has the highest risk of causing skin cancers.

Suggest how scientists could gather evidence to find out which has the highest risk.

_____

_____

_____

_____ **[2]**

(c) Pale and darker skins can both be affected by UV light.

(i) Darker skins reduce the risk of skin cancer.
Explain why.

_____

_____

_____ **[2]**

(ii) **Look at the table. It shows information for different skin types.**

Recommended safe time for being in the sun in hours			
Skin type A	Skin type B	Skin type C	Skin type D
1.0	0.4	0.7	0.2

If factor 10 sunscreen is used, which skin types will be safe for being in the sun for 5 hours?

Skin types

_____ **[1]**

[TOTAL: 6]

2 Microwave ovens can be used to cook potatoes.

Conventional ovens can also cook potatoes, using infrared waves.

(a) Infrared waves crisp the skin of the potato, but the microwaves do not. Explain why.

_____

_____

_____

_____ **[2]**

(b) The microwave oven cooks the potato more quickly. Explain why.

_____

_____

_____

_____ **[2]**

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QUESTION 2(c) BEGINS ON PAGE 14

(c) **Some ovens combine microwave and infrared cooking.**

Look at the information about a combination oven.

Setting	Energy used per second in joules	Time to cook a 500 g potato in minutes	Result
Microwaves only	1200	8	fully cooked
Infrared only	2000	60	fully cooked and crispy on outside
Combination microwave and infrared	3200	8	fully cooked and crispy on outside

The combination setting provides more energy per second.

Suggest why the combination setting still takes 8 minutes to cook the potato.

_____

_____

_____ **[2]**

[TOTAL: 6]

3 Sophia wants to buy a new kettle.

She is not sure which one to buy.

The two kettles in the table are identical, apart from the material they are made out of.

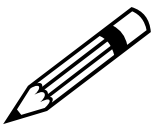
	Metal alloy kettle	Stainless steel kettle
Specific heat capacity	400 J / kg °C	500 J / kg °C
Mass of metal in kettle	1.5 kg	1.2 kg
Mass of water in kettle	1.8 kg	1.8 kg
Power	3 kW	3 kW

Sophia puts 1.8 kg of cold water, at 20 °C, in each kettle.

She thinks that the alloy kettle will take a shorter time to heat the water up to boiling point (100 °C).

She finds that both kettles take the SAME time to reach 100 °C.

Explain why the kettles take the same time to heat the water up to 100 °C.



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

[6]

[TOTAL: 6]

4 Electromagnetic waves have a range of wavelengths.

(a) Look at the list of electromagnetic waves.

GAMMA

INFRARED

VISIBLE LIGHT

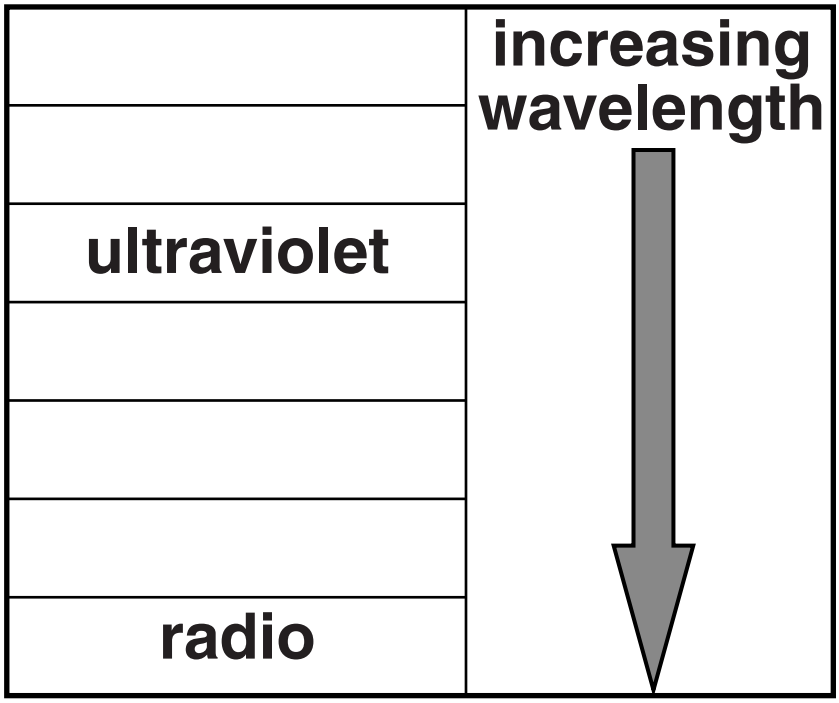
MICROWAVE

RADIO

ULTRAVIOLET

X-RAYS

Complete the table below. Put the waves in order of INCREASING wavelength. Two waves have been done for you.



[2]

(b) What is meant by the FREQUENCY of a wave?

_____

_____ **[1]**

(c) **Infrared waves have different wavelengths.**
They have a range of wavelengths from 0.74×10^{-6} m to 300×10^{-6} m.

The speed of infrared waves in a vacuum is 3.00×10^{8} m/s.

Show that the frequency range of these waves is 4.04×10^{14} Hz.

[4]

[TOTAL: 7]

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SECTION B BEGINS ON PAGE 22

SECTION B – Module P2

5 Nuclear power stations have benefits and risks.

(a) Davinder is worried because he lives near a nuclear power station.

Write about ONE RISK of living near a nuclear power station.

Explain how THIS risk is reduced for people living nearby.

_____

_____

_____

_____ **[2]**

(b) The nuclear power station produces electricity.

The electrical output of the power station is connected to transformers.

The outputs of these transformers are connected to the National Grid.

Why are these transformers used and how is this important for the National Grid?

_____

_____

_____

_____ **[3]**

[TOTAL: 5]

6 Comets orbit the Sun and are made of dust and ice.

(a) Some comets take hundreds of years to complete one orbit.

(i) We can only see a comet for a very small part of its orbit.

In which part of its orbit can the comet be seen?

Explain why.

_____

_____

_____

_____ **[2]**

(ii) **The speed of a comet changes during its orbit.**

Describe the shape of its orbit.

Explain how and why the speed changes during the orbit.

You may use a diagram in your answer.

[3]

(b) Asteroids also orbit the Sun.

Some asteroids pass close to Earth. These are called Near Earth Objects (NEOs).

(i) Explain why it is difficult for scientists to observe these NEOs.

_____

_____ **[1]**

(ii) One day, scientists may discover an asteroid on a collision course with the Earth.

One method to protect the Earth would be to use a long-range missile which explodes at the asteroid.

Explain the advantages and disadvantages of using this method to protect the Earth.

_____

_____

_____

_____

_____ **[3]**

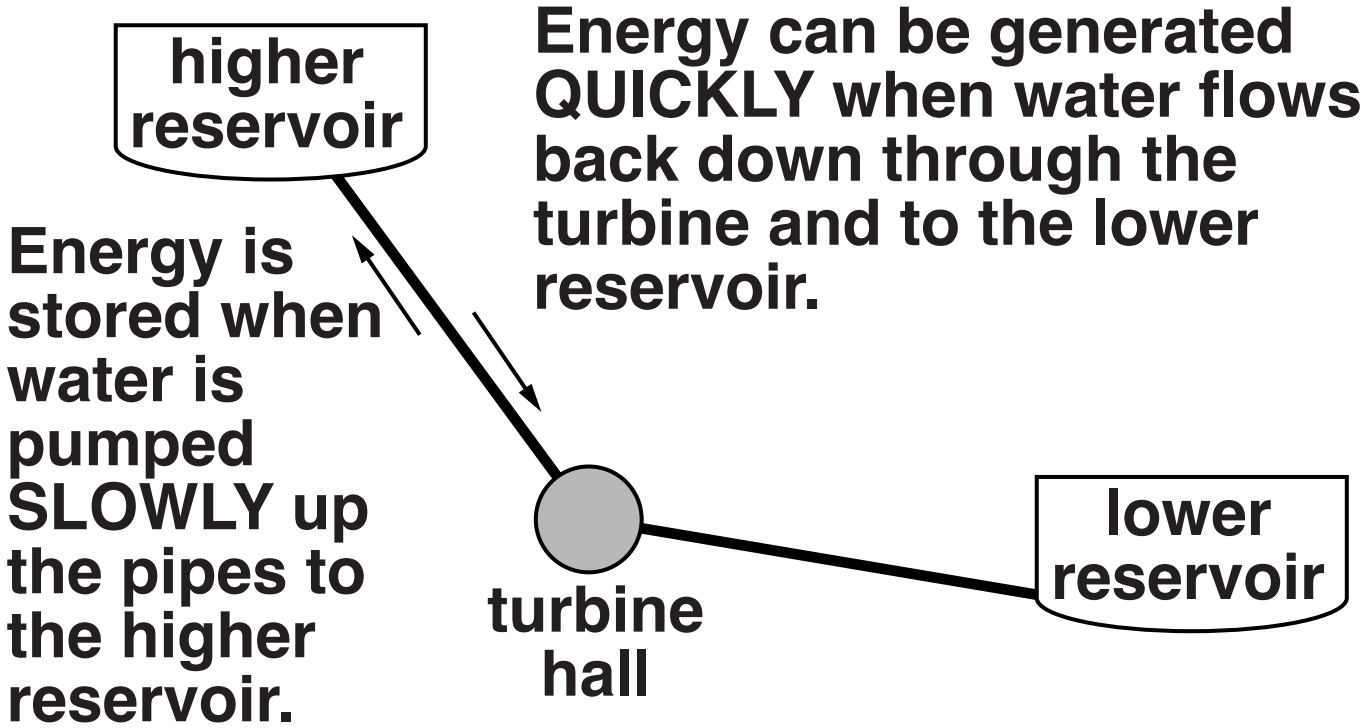
[TOTAL: 9]

7 Fuel power stations produce electricity STEADILY, 24 hours a day.

Some fuel power stations make use of a pumped storage system to help meet the demand for electricity.

At night, the pumped storage system is used to store surplus energy from the fuel power station.

Look at the diagram of a pumped storage system which uses water.



Explain how the pumped storage system can benefit suppliers and consumers of electricity during a 24 hour period.

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

[6]

[TOTAL: 6]

8 Electrical power can be generated in many ways.

Look at the data on different types of power generation.

Power generator	% Efficiency
Wind turbine farm	30
Coal power station	34
Nuclear power station	35
Oil power station	32
Gas power station	45

(a) Coal, oil, gas and nuclear are all types of THERMAL power station.

Why are all these called thermal power stations?

_____

_____ **[1]**

(b) Thermal power stations are more efficient than wind turbine farms.

Suggest why wind turbine farms are often preferred to thermal power stations.

_____

_____ **[1]**

(c) The coal power station has an input power of 500 MW.

Using information in the table, calculate the energy in MJ wasted each MINUTE in this power station.

_____

_____

_____

_____ **[3]**

[TOTAL: 5]

SECTION C – Module P3

9 Colin walks to school.

Look at the graph opposite representing his journey.

(a) Use the graph to calculate Colin's AVERAGE speed for the total journey to school.

_____

_____

answer

_____ **m/s [2]**

(b) Use the graph to calculate his speed in PART C of the journey.

_____

_____

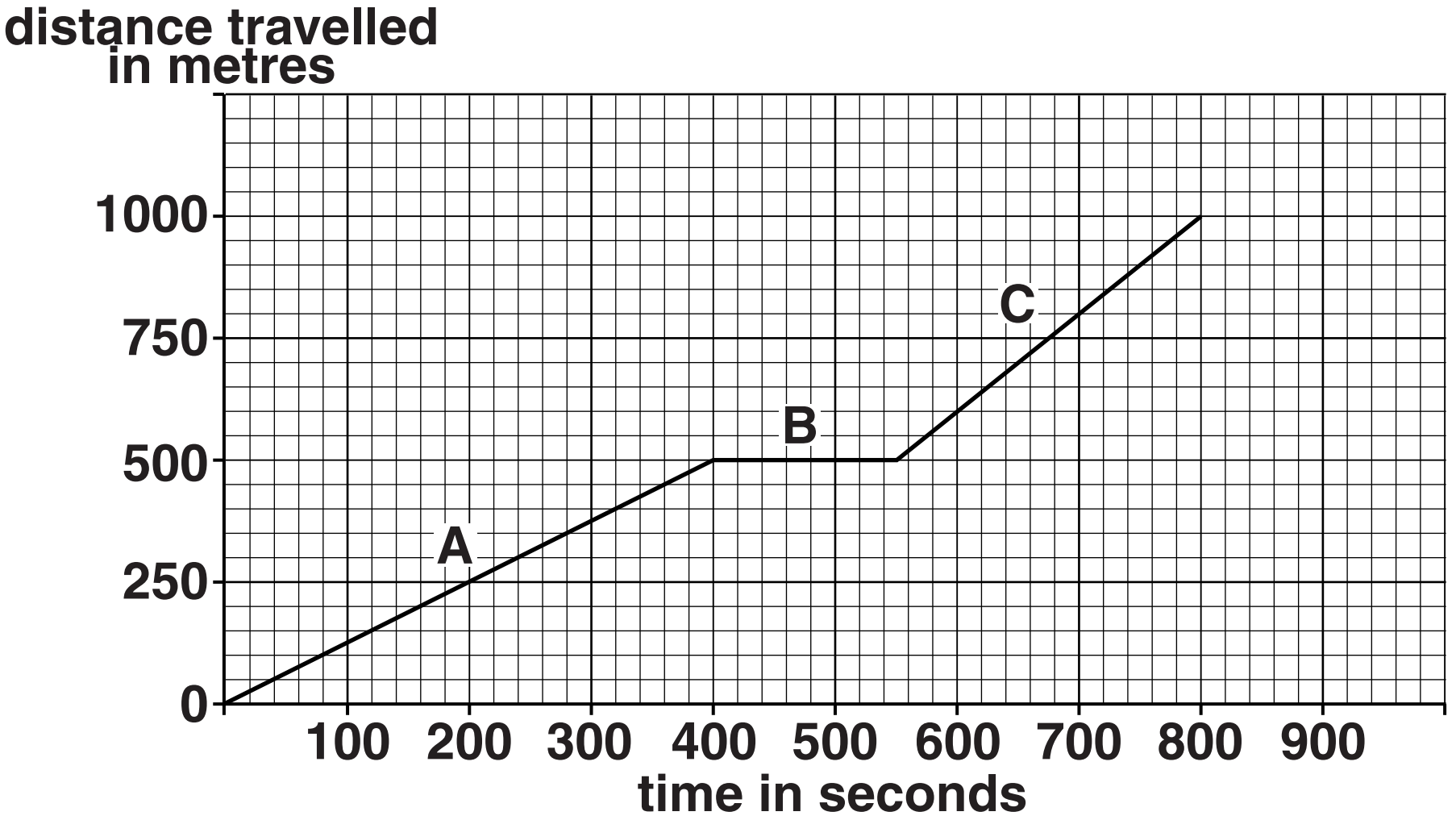
_____

answer

_____ **m/s [2]**

[TOTAL: 4]

33


distance travelled
in metres
1000
750
500
250
0
A
B
C
100
200
300
400
500
600
700
800
900
time in seconds

10 Daisy is going to buy a car.

She looks at some data about five cars.

Car	Engine size in cm^3	Maximum speed in km/h	Emission of CO_2 in g/km	Fuel used per 100 km in litres
A	1000	157	109	4.6
B	1000	157	110	4.7
C	1300	166	104	3.9
D	1400	214	148	6.3
E	2000	206	155	5.5

(a) (i) Which car is the most economical to run over a journey of 50 km?

Choose from: A, B, C, D, or E

answer

_____ [1]

(ii) **Daisy takes car A for a long test drive.**

The manufacturer's data states that it will use 4.6 litres of fuel for a journey of 100 km.

She finds that it uses more fuel than this.

Suggest reasons why.

_____

_____

_____

_____ **[2]**

(b) Daisy considers getting an electric car.

Her friend tells her that they have lots of disadvantages compared with petrol or diesel cars.

Write about the advantages and disadvantages of electric cars.

_____

_____

_____

_____ **[3]**

[TOTAL: 6]

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QUESTION 11 BEGINS ON PAGE 38

11 Scientists investigate the safety of seat belts.

They use two cars. Each car has an identical dummy in the driver's seat.

Both cars are crashed, at the same speed, into identical barriers.

In one car, the dummy is wearing a seat belt. In the other car, the dummy is not wearing a seat belt and hits the windscreen in the collision.

Look at the results.

	Crash with seat belt	Crash without seat belt
Mass of dummy	60 kg	60 kg
Distance travelled by dummy whilst stopping	60 cm after seat belt locked	20 cm after hitting windscreen
Time taken for dummy to stop moving	0.08 sec	0.03 sec
Deceleration	175 m/s^2	467 m/s^2
Stopping force	10500 N	

Calculate the missing data and use the information in the table to explain how seat belts reduce injury in a crash.

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

[6]

[TOTAL: 6]

12 Emma drops a rock from the top of a cliff.

(a) The rock has a mass of 0.5 kg.

As the rock falls it loses potential energy and gains kinetic energy.

The rock is travelling at a speed of 15 m/s just before it hits the ground.

Calculate the distance the rock falls.

Take the value of g to be 10 N/kg.

Ignore the effect of air resistance.

_____

_____

_____

_____

answer

_____ **metres [3]**

(b) Emma drops another rock.

This rock has a mass of 1.0 kg.

The rock hits the ground at the same speed.

Explain why.

_____

_____

_____ **[1]**

[TOTAL: 4]

13 (a) There can be problems with vehicles travelling too fast down long steep hills.

For safety there are often escape lanes near the bottom of steep hills.

Drivers can drive left, off the main road, into the escape lane.

These escape lanes are filled with sand and sometimes slope upwards.

They allow vehicles to stop safely in an emergency when the brakes are not very effective.

Explain how these escape lanes can reduce the braking force needed by the vehicle, when the driver makes an emergency stop.

_____

_____

_____ [2]

(b) In the UK, it is illegal to travel in a car without wearing a seatbelt.

Some passengers do not like wearing seatbelts.

Write about the RISKS AND BENEFITS of wearing seatbelts for the passengers and for the wider community.

_____

_____

_____

_____

_____

_____ **[3]**

[TOTAL: 5]

END OF QUESTION PAPER