Resources available from kickstart tutors

Student number

Name

Date

Attempt/Time taken

GCSE
PHYSICS

Topic Paper: 5.7 Momentum (Higher tier only)
Part 3

Time allowed: 40 minutes

Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

Instructions

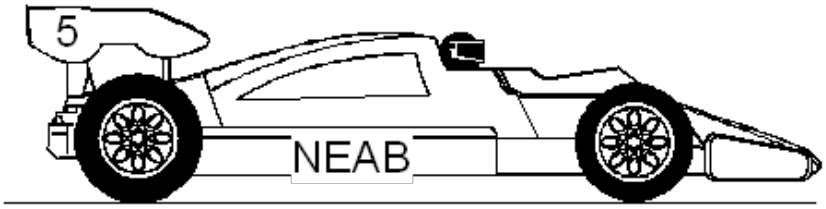
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

35 Marks

Q10. A racing driver is driving his car along a **straight** and **level** road as shown in the diagram below.



(a) The driver pushes the accelerator pedal as far down as possible. The car does not accelerate above a certain maximum speed. Explain the reasons for this in terms of the forces acting on the car.

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(4)

(b) The racing car has a mass of 1250 kg. When the brake pedal is pushed down a constant braking force of 10 000 N is exerted on the car.

(i) Calculate the acceleration of the car.

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(ii) Calculate the kinetic energy of the car when it is travelling at a speed of 48 m/s.

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(iii) When the brakes are applied with a constant force of 10 000 N the car travels a distance of 144 m before it stops. Calculate the work done in stopping the car.

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(12)
(Total 16 marks)

Q11. The diagram shows a high jumper.

In order to jump over the bar, the high jumper must raise his mass by 1.25 m.
The high jumper has a mass of 65 kg. The gravitational field strength is 10 N/kg.

(a) The high jumper just clears the bar.

Use the following equations to calculate the gain in his gravitational potential energy.

weight = mass ×gravitational field strength

(newton, N) (kilogram, kg) (newton/kilogram, N/kg)

change in gravitational potential energy = weight ×change in vertical height

(joule, J) (Newton, N) (metre, m)

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Gain in gravitational potential energy ..... J

(4

(b) Use the following equation to calculate the minimum speed the high jumper must reach for take-off in order to jump over the bar.

kinetic energy = $\frac{1}{2}$ **×mass ×[speed]** ^{2}

(joule, J) (kilogram, kg) [(metre/second)^2, (m/s)^2

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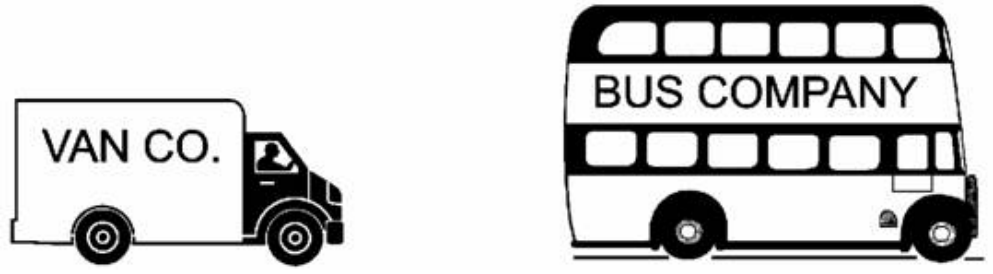
Speed ..... m/s

(3)

(Total 7 marks)

Q12. 'SPEED KILLS' - was the heading of an advertising campaign. The scientific reason for this is that energy is transferred from the vehicle to the person it knocks down.



(a) The bus and the van are travelling at the same speed. The bus is more likely to cause more harm to a person who is knocked down than the van would. Explain why.

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(2)

(b) A car and its passengers have a mass of 1200 kg. It is travelling at 12 m/s.

(i) Calculate the increase in kinetic energy when the car increases its speed to 18 m/s.

Show clearly how you work out your answer and give the unit.

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Increase in kinetic energy = ...

(5)

(ii) Explain why the increase in kinetic energy is much greater than the increase in speed.

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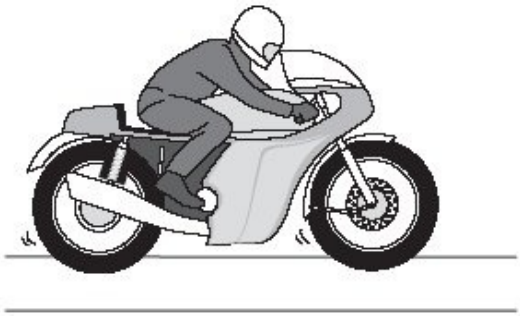
(1)

(Total 8 marks)

Q13. The diagram shows a motorbike of mass 300 kg being ridden along a straight road.



The rider sees a traffic queue ahead. He applies the brakes and reduces the speed of the motorbike from 18 m/s to 3 m/s.

(a) Use the equation in the box to calculate the kinetic energy lost by the motorbike.

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{speed}^2$$

Show clearly how you work out your answer.

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Kinetic energy lost = ... J

(2)

(b) (i) How much work is done on the motorbike by the braking force?

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(1)

(ii) What happens to the kinetic energy lost by the motorbike?

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(1)

(Total 4 marks)