Resources available from kickstart tutors

Student number

Name

Date

Attempt/Time taken

GCSE
PHYSICS

Topic Paper: 5.7 Momentum (Higher tier only)
Part 1

Time allowed: 45 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.

40 Marks

Q1. The figure below shows a skateboarder jumping forwards off his skateboard.

The skateboard is stationary at the moment the skateboarder jumps.

(a) The skateboard moves backwards as the skateboarder jumps forwards.

Explain, using the idea of momentum, why the skateboard moves backwards.

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(3)

(b) The mass of the skateboard is 1.8 kg and the mass of the skateboarder is 42 kg.

Calculate the velocity at which the skateboard moves backwards if the skateboarder jumps forwards at a velocity of 0.3 m / s.

Use the correct equation from the Physics Equations Sheet.

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Velocity of skateboard = ... m / s

(3)

(Total 6 marks)

Q2. (a)In any collision, the total momentum of the colliding objects is usually conserved.

(i)What is meant by the term 'momentum is conserved'?

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(1)

(ii)In a collision, momentum is **not always** conserved.

Why?

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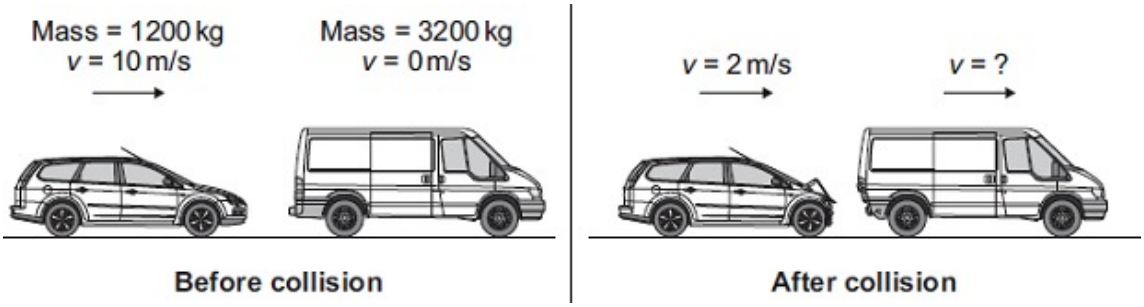
(1)

(b) The diagram shows a car and a van, just before and just after the car collided with the van.



(i)Use the information in the diagram and the equation in the box to calculate the **change** in the momentum of the car.

momentum = mass x velocity

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

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Change in momentum = ...

(3)

(ii)Use the idea of conservation of momentum to calculate the velocity of the van when it is pushed forward by the collision.

Show clearly how you work out your answer.

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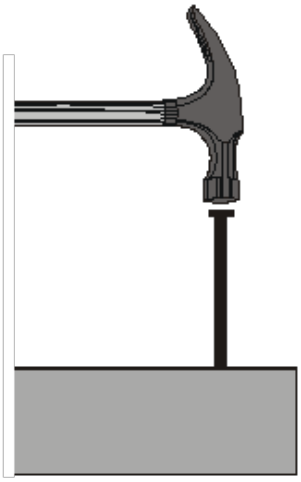
Velocity = ... m/s forward

(2)

(Total 7 marks)

Q3. (a) The diagram shows a hammer which is just about to drive a nail into a block of wood.



The mass of the hammer is 0.75 kg and its velocity, just before it hits the nail, is 15.0 m/s downward. After hitting the nail, the hammer remains in contact with it for 0.1 s. After this time both the hammer and the nail have stopped moving.

(i) Write down the equation, in words, which you need to use to calculate momentum.

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(1)

(ii) What is the momentum of the hammer just before it hits the nail?

Show how you work out your answer and give the units and direction.

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Momentum = ...

(3)

(iii) What is the change in momentum of the hammer during the time it is in contact with the nail?

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(1)

(iv) Write down an equation which connects *change in momentum*, *force* and *time*.

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(1)

(v) Calculate the force applied by the hammer to the nail.

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

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Force = ...

(3)

(b) A magazine article states that:

"Wearing a seat belt can save your life in a car crash."

Use your understanding of momentum to explain how this is correct.

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(4)

(Total 13 marks)

Q4. (a)In any collision, the total momentum of the colliding objects is usually conserved.

(i) What is meant by the term 'momentum is conserved'?

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(1)

(ii)In a collision, momentum is **not** always conserved.

Why?

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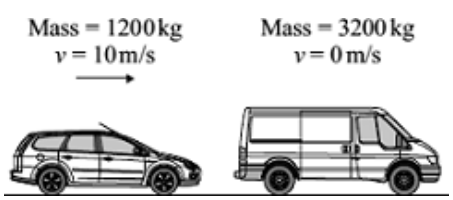
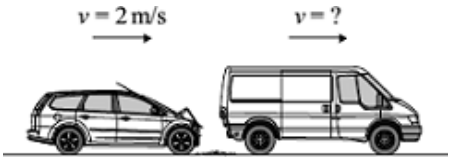
(1)

(b) The diagram shows a car and a van, just before and just after the car collided with the van.



Before collision



After collision

(i) Use the information in the diagram and the equation in the box to calculate the **change** in the momentum of the car.

momentum=mass×velocity

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

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Change in momentum =.....

(3)

(ii)Use the idea of conservation of momentum to calculate the velocity of the van when it is pushed forward by the collision.

Show clearly how you work out your answer.

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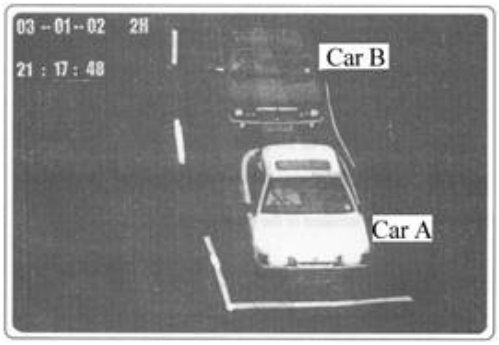
Velocity =..... m/s forward

(2)
(Total 7 marks)

Q5. The roads were very icy. An accident was recorded by a security camera.



Car **A** was waiting at a road junction. Car **B**, travelling at 10 m/s, went into the back of car **A**. This reduced car **B**'s speed to 4 m/s and caused car **A** to move forward.

The total mass of car **A** was 1200 kg and the total mass of car **B** was 1500 kg.

(i) Write down the equation, in words, which you need to use to calculate momentum.

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(1)

(ii) Calculate the change in momentum of car **B** in this accident.

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

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Change in momentum = ...

(3)

(iii) Use your knowledge of the conservation of momentum to calculate the speed, in m/s, of car **A** when it was moved forward in this accident.

Show clearly how you work out your final answer.

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Speed = ... m/s

(3)

(Total 7 marks)