The kinetic energy of objects speeding up or slowing down

1. The diagram shows an adult and a child pushing a loaded shopping trolley.

(a) (i) What is the *total force* on the trolley due to the adult and child?

.....

(1)

(ii) Which **one** of the terms in the box means the same as *total force*?

Draw a ring around your answer.

answer force	**mean force**	**resultant force**

(1)

(iii) The trolley is pushed at a constant speed for 80 metres.

Use the equation in the box to calculate the work done to push the trolley 80 metres.

work done = force applied × distance moved in direction of force

Show clearly how you work out your answer.

.....

.....

Work done = ...

(2)

(b) Complete the following sentences by drawing a ring around the correct word in each of the boxes.

(i) The unit of work done is the

joule
newton
watt

.

(1)

(ii) Most of the work done to push the trolley is transformed into

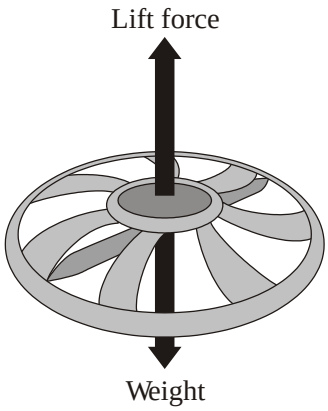
heat
light
sound

.

(1)

(Total 6 marks)

2. The diagram shows the forces on a small, radio-controlled, flying toy.



(a) (i) The mass of the toy is 0.06 kg.
Gravitational field strength = 10 N/kg

Use the equation in the box to calculate the weight of the toy.

weight = mass × gravitational field strength

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

.....

.....

Weight = ...

(3)

(ii) Complete the following sentence by drawing a ring around the correct line in the box.

When the toy is hovering stationary in mid-air, the lift force is

bigger than the same as smaller than	the weight of the toy.

(1)

(b) When the motor inside the toy is switched off, the toy starts to *accelerate* downwards.

(i) What does the word *accelerate* mean?

.....

(1)

(ii) What is the direction of the resultant force on the falling toy?

.....

(1)

(iii) Does the momentum of the toy increase, decrease or stay the same?

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Give a reason for your answer.

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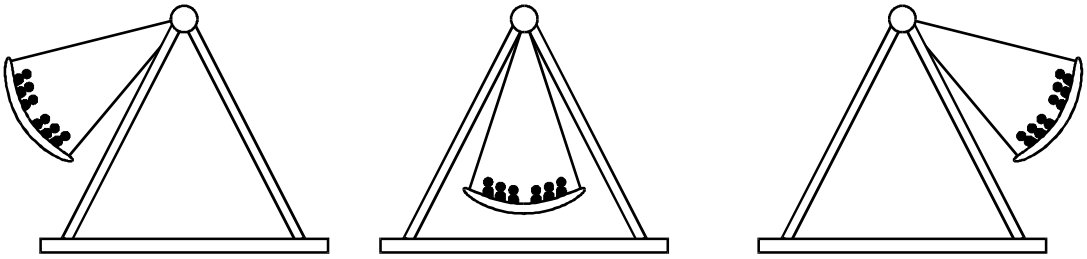
(2)

(Total 8 marks)

3. The Boat is a theme park ride. The Boat swings backwards and forwards. The diagrams show the Boat at the top and bottom of its swing.



A **B** **C**

(a) As the Boat swings from its position in **A** to its position in **B**, a child on the ride gains 5070 joules of kinetic energy. The child has a mass of 60 kg and is sitting at the centre.

(i) Write down the equation which links kinetic energy, mass and speed.

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(1)

(ii) Calculate the speed of the child as the Boat passes through **B**. Show clearly how you work out your final answer.

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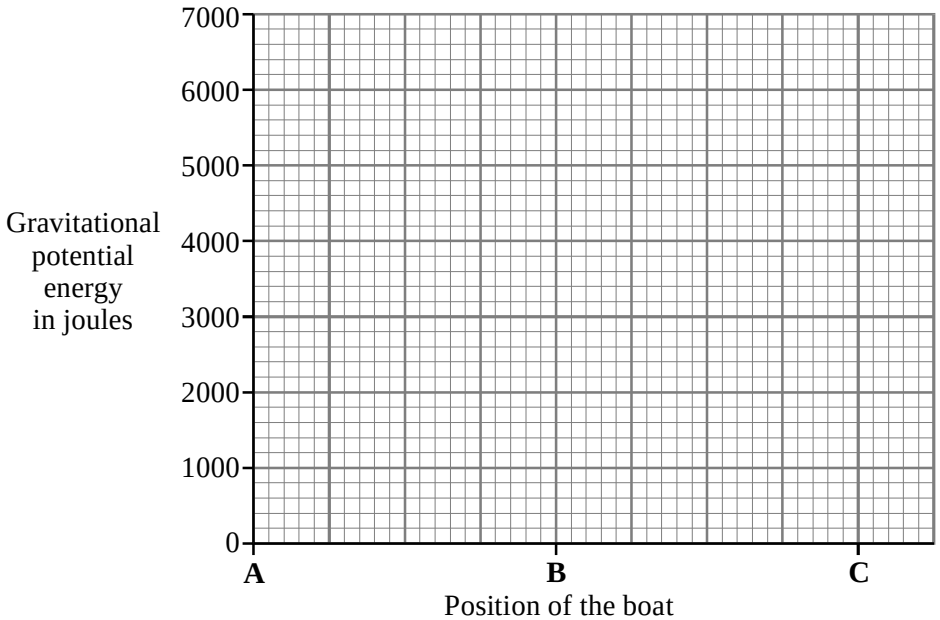
Speed = ... m/s

(2)

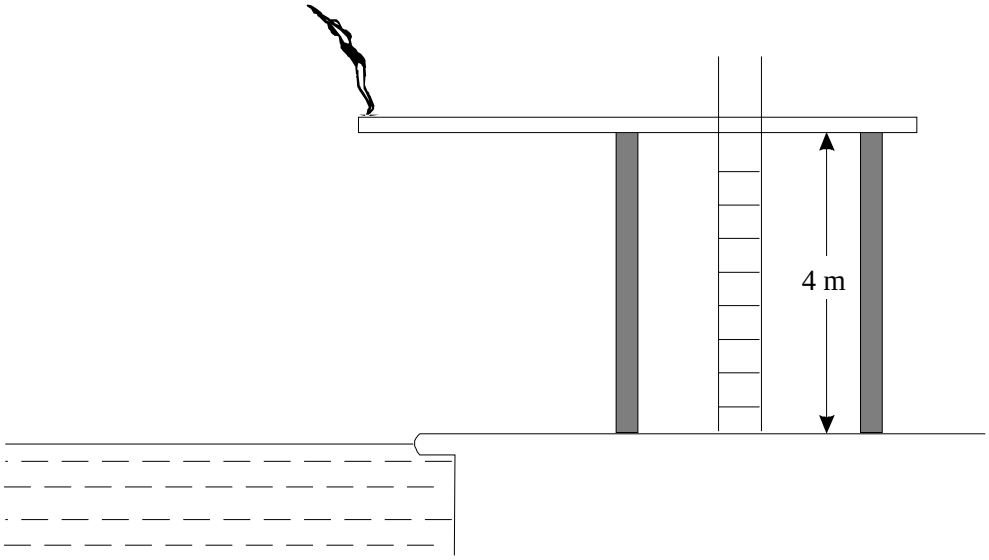
(b) Sketch a graph to show how the gravitational potential energy of the child changes as the Boat swings from **A** to **B** to **C**. The axes have been drawn for you.



(2)

(Total 5 marks)

4. The diagram shows a diver diving from the end of a diving board.



The height of the diving board above the poolside is 4 m. The mass of the diver is 50 kg. Gravitational field strength is 10 N/kg.

(a) Calculate the gain of gravitational potential energy as the diver climbs from the poolside to the diving board.

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(4)

(b) The diver enters the water at a speed of 8 m/s.

Calculate the kinetic energy of the diver as she hits the water.

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(4)

(c) As she hits the water her kinetic energy is different from the potential energy she gained as she climbed to the diving board. Explain why.

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(2)

(Total 10 marks)

5. (a) The amount of damage caused when a car collides with a wall depends on the amount of energy transferred.

If the speed of a car **doubles**, the amount of energy transferred in a collision increases **four** times.

Explain, as fully as you can, why this is so.

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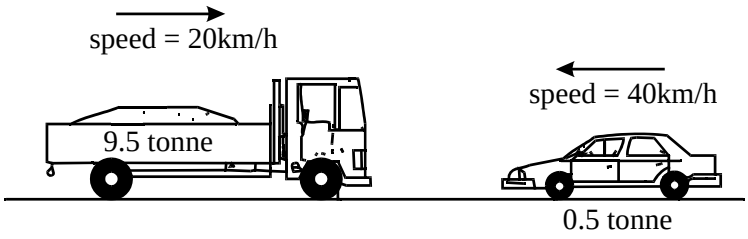
(3)

(b) The diagram shows a car and a lorry about to collide.



When they collide, the two vehicles become tightly locked together.

Calculate the speed of the vehicles immediately after the collision.

(Show your working. There is no need to change to standard units.)

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Answer ..... km/h

(6)

(Total 9 marks)