

GCSE Physics (9 – 1)

Kinetic Energy

Name:

Group:



Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.

For markers use	
Question	Mark
1	/6
2	/6
3	/6
4	/11
5	/6
6	/8
Total	/43
%	
Grade	

Information

- The maximum mark for this paper is 43 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.

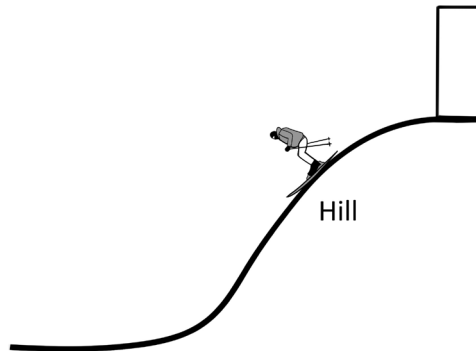


1. Kinetic energy is the energy stored in moving objects, and its size depends on just **two** factors: the mass of the object and the square of its velocity.

Circle the letter of the correct answer for each for the following questions.

- a) A snowboarder hikes to the top of a mountain run and gains 15,000 J of gravitational potential energy. He rides down the mountain. Upon reaching the bottom of the run, his kinetic energy is 3,500 J.

How much energy was lost to friction and air resistance as the snowboarder travelled down the slope?



- | | | | |
|----------|----------|----------|----------|
| A | B | C | D |
| 3500 J | 11500 J | 15000 J | 18500 J |

(1 mark)

- b) A cyclist and their bike have a total mass of **80 kg**. They are travelling at a speed of **6 m/s**.



What is the kinetic energy of the cyclist?

- | | | | |
|----------|----------|----------|----------|
| A | B | C | D |
| 2880 J | 1440 J | 15000 J | 18500 J |

(1 mark)

- c) A drone with a mass of 500 g is flying at a speed of 12 m/s.



Calculate the kinetic energy of the drone.

- | | | | |
|----------|----------|----------|----------|
| A | B | C | D |
| 36 J | 72 J | 36000 J | 72000 J |

(1 mark)

d) A car with a mass of 1000 kg has 20 000 J of kinetic energy.

What is the speed of the car?

A

6.3 m/s

B

20 m/s

C

40 m/s

D

400 m/s

(1 mark)

e) A bullet with a mass of 20 g is fired. It has a kinetic energy of 900 J.

Calculate the speed of the bullet.

A

9.5 m/s

B

212 m/s

C

300 m/s

D

90000 m/s

(1 mark)

f) A truck with a mass of 4 tonnes is travelling at a speed of 54 km/h.

Calculate the kinetic energy of the truck.

A

450 J

B

5832 J

C

450 000 J

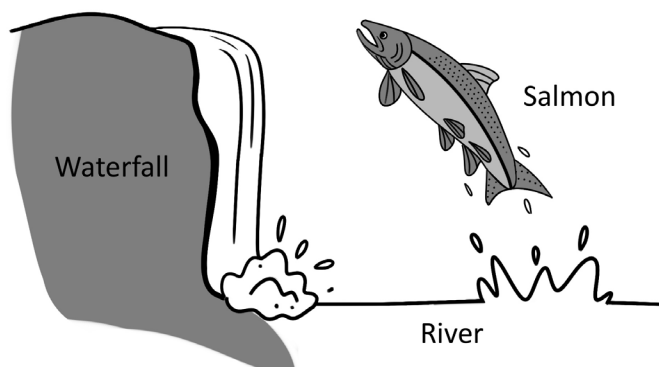
D

5 832 000 J

(1 mark)

(Total for Question 1 is 6 marks)

2. While migrating upstream to spawn, salmon must often leap up waterfalls. The diagram below shows a salmon launching itself out of the water. On this specific jump, the salmon fails to reach the top and falls back down into the river.



- a) The salmon has a mass of 2 kg, it launches vertically from the water with a kinetic energy of 20.4 J. Calculate the speed of the salmon as it jumps from the water.

Speed = ... m/s

(2 marks)

- b) Determine the maximum height reached by the salmon.

Maximum height = ... m

(3 marks)

- c) When the salmon splashes back down into the river, it loses almost all of its kinetic energy. Describe what has happened to this energy.

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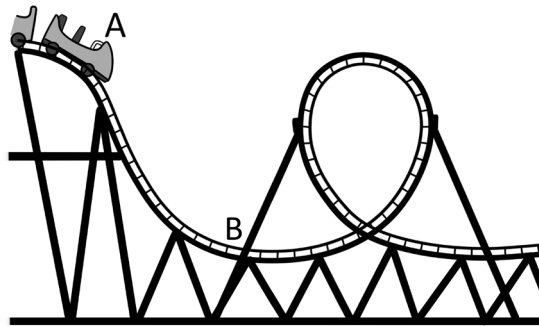
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(2 marks)

(Total for Question 1 is 6 marks)

3. A theme park has a new rollercoaster called 'The Drop'.

The figure below shows the new rollercoaster.



A rollercoaster carriage with a total mass of 600 kg is travelling along a horizontal section of the track.

- a) Write down the equation that links kinetic energy (E_k), mass (m) and speed (v).

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(1 mark)

- b) At point A, the carriage is travelling at a speed of 12 m/s.
Calculate the kinetic energy of the carriage at point A.

Kinetic energy = ... J
(2 marks)

- c) The carriage descends a steep drop and reaches its maximum speed at point B.

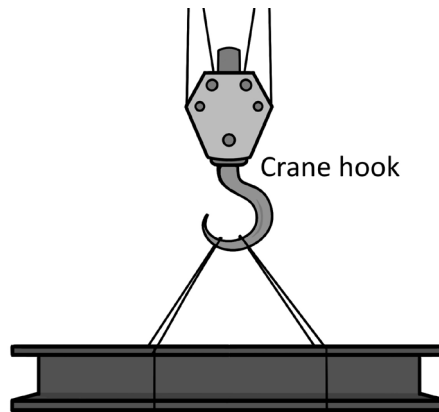
At point B, the carriage has a kinetic energy of 147 000 J.

Calculate the speed of the carriage at point B. Show your working.

Speed = ... m/s
(3 marks)

(Total for Question 3 is 6 marks)

4. A construction worker is using a crane to lift a steel beam on a building site.
The steel beam has a mass of 800 kg.



- a) The crane is using energy to lift the steel beam.
State the law of conservation of energy.

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(2 marks)

- b) The crane lifts the beam vertically to a height of 25 m.
Calculate the gravitational potential energy gained by the beam.

Gravitational potential energy = ... J
(2 marks)

- c) It takes the crane 50 seconds to lift the beam to this height.
Calculate the useful power output of the crane's motor.

Power = ...W
(2 marks)

- d) While the beam is suspended at a height of 25 m, the cable snaps and the beam falls to the ground. There is an air resistance of 1500 N acting on the beam as it falls.

Calculate the speed of the beam just before it hits the ground.

Use the equation: work done = force $\times$ distance

Speed = ... m/s

(5 marks)

(Total for Question 4 is 11 marks)

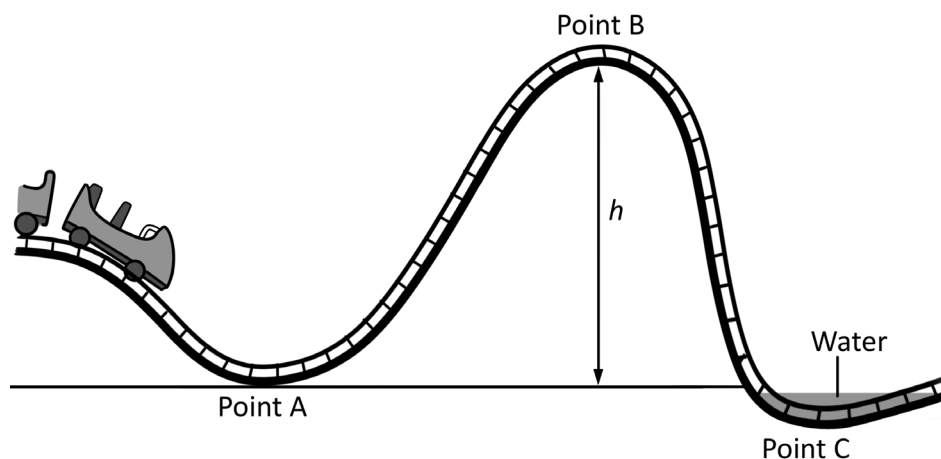
- Describe a laboratory experiment the student could perform to investigate this relationship.

- A list of the equipment needed.
- The measurements that need to be taken.
- How the student can determine the kinetic energy of the car.

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(Total for Question 5 is 6 marks)

6. The figure below shows a cart on a roller coaster at a fair ground.



- a) The mass of the cart is 500 kg. The kinetic energy of cart at point A = 180.5 kJ
Calculate the speed of the cart.

Speed = ... m/s
(3 marks)

- b) As the car travels from A to B, it loses 40 kJ of energy due to friction.
The car just manages to roll over the crest of the hill at B. Calculate the height h .

Height = ... m
(2 marks)

- c) At point C, the cart travels through a shallow pool of water and the kinetic energy of the car is reduced to zero. Make **three** suggestions for what happens to this kinetic energy.

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(3 marks)

(Total for Question 6 is 8 marks)