Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Q1.

Hailstones are small balls of ice. Hailstones form in clouds and fall to the ground.

Figure 1 shows different-sized hailstones.

Figure 1

A hailstone falls from a cloud and accelerates.

(a) Why does the hailstone accelerate?

_____

_____

(1)

(b) The hailstone stops accelerating and reaches terminal velocity.

Explain why the hailstone reaches terminal velocity.

_____

_____

_____

_____

_____

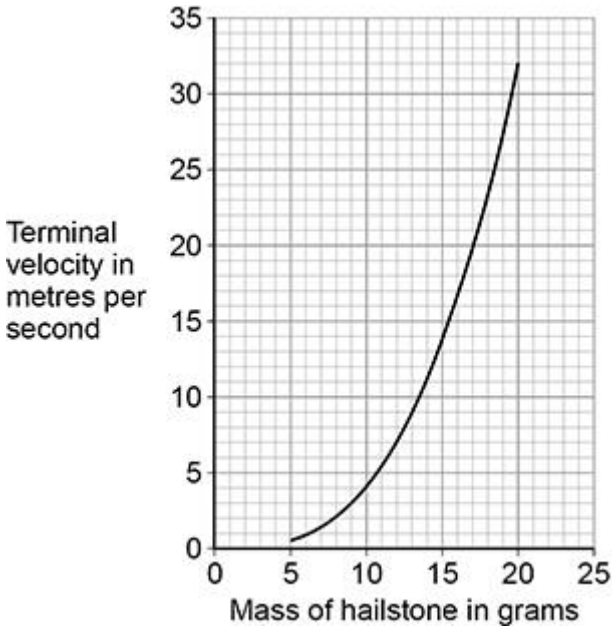
_____

(3)

A scientist investigated how the mass of hailstones affects their terminal velocity.

Figure 2 shows the results.

Figure 2



(c) Why does terminal velocity increase with mass?

Tick (✓) **one** box.

As mass increases the cross-sectional surface area of a hailstone increases. ☐

As mass increases the volume of a hailstone increases. ☐

As mass increases the weight of a hailstone increases. ☐

(1)

(d) Explain the difference in the maximum kinetic energy of a hailstone with a mass of 10 g and a hailstone with a mass of 20 g.

_____

_____

_____

_____

_____

_____

(3)

(e) The kinetic energy of a hailstone is measured in joules.

Which of the following is the same as 1 joule?

Tick (✓) **one** box.

1 N m ☐

1 N/m ☐

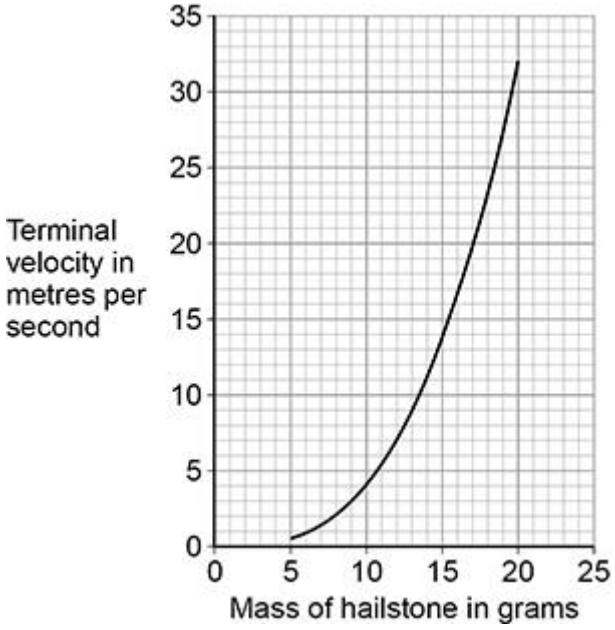
1 N/m^2 ☐

1 N m^2 ☐

(1)

Figure 2 is repeated below.

Figure 2



(f) A hailstone hit the ground at its terminal velocity of 25 m/s.

The hailstone took 0.060 s to stop moving.

Determine the average force on the hailstone as it hit the ground.

Use information from **Figure 2**.

Use the Physics Equations Sheet.

_____

_____

_____

_____

_____

Average force = _____ N

(3)

(Total 12 marks)

Q2.

(a) During one year, 1.25×10^{18} J of energy was transferred from the National Grid.

number of seconds in 1 year = 3.16×10^{7}

Calculate the mean energy transferred from the National Grid each second.

Give your answer to 3 significant figures.

_____

_____

_____

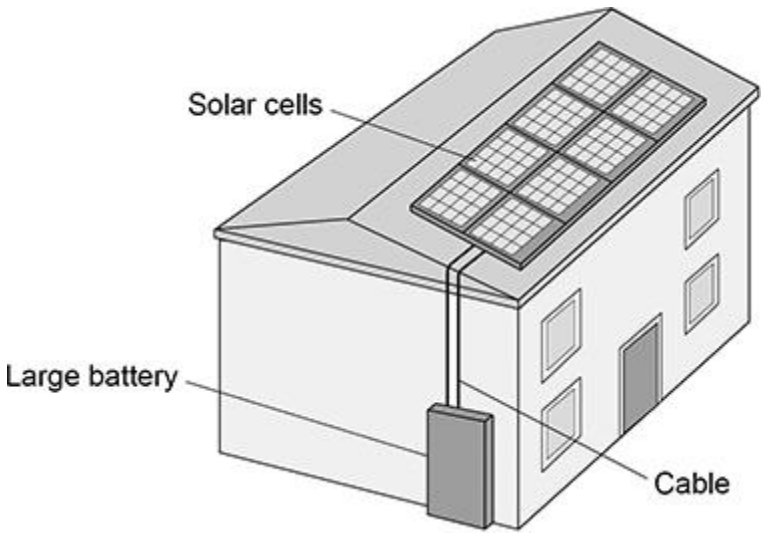
Energy each second (3 significant figures) = _____ J

(2)

The figure below shows a house with a solar power system.

The solar cells generate electricity.

When the electricity generated by the solar cells is not needed, the energy is stored in a large battery.



(b) The charge flow through the cable between the solar cells and the battery in 24 hours was 27 000 coulombs.

Calculate the mean current in the cable.

_____

_____

Mean current = _____ A

(4)

(c) At one time, the total power input to the solar cells was 7.8 kW.

The efficiency of the solar cells was 0.15

Calculate the useful power output of the solar cells.

Useful power output = _____ W

(3)

(d) It is unlikely that **all** of the electricity that the UK needs can be generated by solar power systems.

Explain why.

(2)

(Total 11 marks)