AS Level Physics

Chapter 6 – Further Mechanics

6.1.2 Impulse

Worked Examples

Impulse

Exam Style Question 2

a) State Newton's second and third laws of motion.

b) A golfer uses a golf club to hit a stationary golf ball off the ground. Fig. 1.1 shows how the force F on the golf ball varies with time t when the club is in contact with the ball.

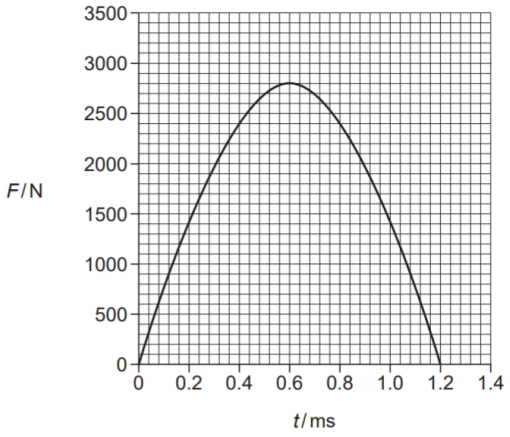

Fig. 1.1

i) Estimate the area under the graph.

ii) Name the physical quantity represented by the area under the graph in (i).

iii) Show that the speed of a golf ball, of mass $0.046\ kg$, as it leaves the golf club is about $50\ m\ s^{-1}$.

Impulse

Exam Style Question 2

Answer

a) State Newtons second and third laws of motion.

- Newton's second law: Force is proportional to the rate of change of momentum.
- Newton's third law: When one body exerts a force on another the other body exerts an equal and opposite force on the first body.

bi) Estimate the area under the graph.

Step 1: Count the number of squares under the graph:

About 22 large squares = about 550 small squares

The question allows the estimation for the number of squares counted to be between a range of 500-600.

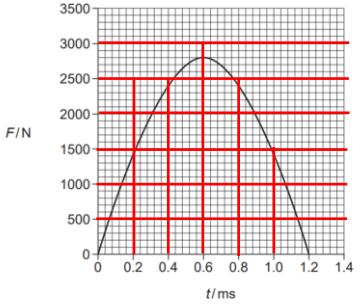

Fig. 1.1

Step 2: Find out the area of one square:

$$F \times t = 100\ N \times (0.04 \times 10^{-3}\ s) = 4 \times 10^{-3} N\ s$$

Step 3: Calculate the area under the graph:

$$550\ squares \times (4 \times 10^{-3}) = 2.2\ N\ s$$

tutorpacks.co.uk

Impulse

Exam Style Question 2

a) State Newton's second and third laws of motion.

b) A golfer uses a golf club to hit a stationary golf ball off the ground. Fig. 1.1 shows how the force F on the golf ball varies with time t when the club is in contact with the ball.

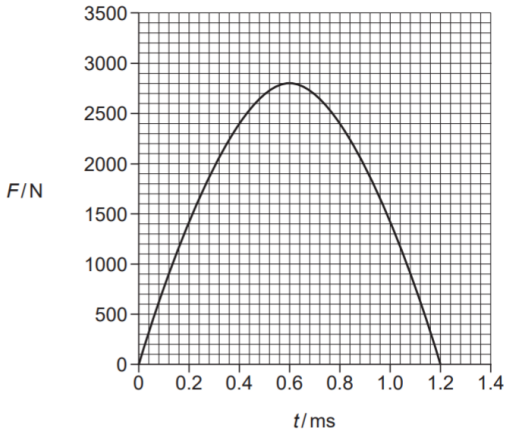

Fig. 1.1

i) Estimate the area under the graph.

ii) Name the physical quantity represented by the area under the graph in (i).

iii) Show that the speed of a golf ball, of mass $0.046\ kg$, as it leaves the golf club is about $50\ m\ s^{-1}$.

Impulse

Exam Style Question 2

Answer

bii) Name the physical quantity represented by the area under the graph in (i).
Impulse.

biii) Show that the speed of a golf ball, of mass $0.046\ kg$, as it leaves the golf club is about $50\ m\ s^{-1}$.
Use: Impulse = change in momentum

$$F\Delta t = m\Delta v$$

We already calculated impulse $(= F\Delta t)$ is $2.2\ N\ s$.
Therefore:

$$2.2\ N\ s = (0.046\ kg)v$$

Rearrange for v:

$$v = \frac{2.2\ N\ s}{0.046\ kg} = 47.82608696\ m\ s^{-1} \approx 50\ m\ s^{-1}$$

tutorpacks.co.uk

Please see ‘6.1.1 Impulse notes’ pack for revision notes.

For more revision notes, tutorials and worked examples please visit www.tutorpacks.co.uk.

tutorpacks.co.uk