Learning Resource

Biomechanics

Tasks & Solutions

43 pages

CONTENTS

A Linear motion p2 - velocity and acceleration;

B Forces and Newton's Laws p14 - force, inertia and momentum.

C Impulse, Net force, Projectile motion p26 - sprinting to demonstrate concept of impulse; high jump to demonstrate concept of net forces; shot putting to demonstrate projectile motion.

D Angular motion p40 Concept of angular momentum and its conservation during flight. Moment of inertia, and its relationship with angular velocity as shown during somersaulting and spinning.

Each task provides information which contains embedded questions to reinforce learning. Answers are provided for instant feedback but could be covered for self-testing.

A Linear Motion

Task 1

Consider a man running in a straight line. If the man runs 600 metres in 2 minutes, we can calculate his average speed, because:

Average speed = Distance covered ÷ Time taken

In this case, the man travelled 600 metres in 2 minutes. 2 minutes is the same as 120 seconds,

And hence his average speed = 600 ÷ 120 = 5.00 metres per second (ms^{-1})

a What would be the average speed of a man who jogged 600 metres in 3 minutes? Do this calculation in the space below:

3 mins is the same as 180 seconds

600 ÷ 180 = 3.33 ms^{-1}

Similarly, we can calculate the time taken to cover a distance, if we know the average speed.

Consider a man running at 4.00 ms^{-1}.

In 4 minutes (or 4 x 60 = 240 seconds), he will travel:

Average speed = Distance ÷ Time

Which can be rearranged into:

Distance = Time x Speed

= 240 secs x 4.00 ms^{-1}

= 960 metres

b How far would this man travel if he ran for;

i 10 minutes?:

10 mins is equivalent to 10 x 60 = 600 seconds

600 x 4.00 = 2400 metres

ii 21 minutes?:

21 min equals 21 x 60 = 1260 seconds

1260 x 4.00 = 5040 metres

Task 1 *continued*

c How long would it take for the man to run 1000 metres if he is travelling at 5.00 ms^{-1}?

Time = Distance ÷ speed

Time = 1000 ÷ 5.00 = 200 seconds

= 3 mins and 20 seconds

d How far will a man travel if he walks for 12 minutes at 2.5 $m.s^{-1}$, and then realising he is late, runs for 5 minutes at 6 ms^{-1}?

12 mins is the same as 12 x 60 = 720 seconds

720 x 2.5 = 1800 metres

5 mins is the same as 5 x 60 = 300 seconds

300 x 6 = 1800 metres

he walks 1800 metres and runs 1800 metres – total

distance covered = 3600 metres