Experiment worksheet answers

7.1 Displacement is change in position with direction

Pages 156–157 and 219

Challenge 7.1: Bringing graphs to life

Student answers will vary.

Experiment worksheet answers

7.2 Velocity is speed with direction

Pages 158–159 and 220

Experiment 7.2A: The ticker timer

Discussion

1 Why does the length of each tape column indicate the speed?

The length of each tape column shows the distance travelled in a set period of time (0.1 seconds in this case), so it indicates speed.

2 How could you work out the average speed of each section? (Hint: Average speed = distance ÷ time)

To work out the average speed of each section in metres per second, measure the length of tape in metres and divide this by 0.1 seconds.

3 Why is it only the ‘average’ speed?

This is only the ‘average’ speed as speed may vary slightly within the tenth of a second journey.

4 Design another experiment you could do using a ticker timer. Ask your teacher for permission to carry out your experiment.

In giving approval you need to be careful of both safety and whether the final speed of the object will be slow enough to model with ticker tape. Typically, over 3 m/s is hard to graph

Conclusion

What information can you determine using a ticker timer?

The ticker timer records distance travelled in each fiftieth of a second and so distances and time can be measured to produce a graph showing distance per tenth of a second. This can be scaled to produce a speed–time graph.

Experiment worksheet answers

7.2 Velocity is speed with direction

Pages 158–159 and 221

Experiment 7.2B: Using a motion sensor

Discussion

1 Can you work out what each graph is showing you?

Students’ answers will vary.

2 How well did the graphs represent the actual motion of the trolley that you witnessed?

Students’ answers will vary.

3 Design another experiment you could perform with the motion sensor.

Students’ answers will vary.

4 Evaluate this experiment compared with Experiment 7.2A in which you used the ticker timer. Which measuring instrument did you prefer and why?

Students’ answers will vary.

Conclusion

What information do the graphs created by a motion sensor tell you?

Overall, this method is preferred over the use of the ticker timer as it makes use of labour-saving devices (computers). The data provided produce more accurate graphs, errors inherent with ticker timers are reduced and the procedure saves time. So, using a motion sensor is better for recording data, but not as effective in its demonstration of what is happening as is using a ticker timer.

Experiment worksheet answers

7.3 Acceleration is change in velocity over time

Pages 160–161 and 221

Challenge 7.3: Measuring acceleration by timing or using a motion sensor

Student answers will vary.

Experiment worksheet answers

7.4 An object in motion remains in motion until a force acts on it

Pages 162–163 and 222

Challenge 7.4A: Make an accelerometer

Discussion

1 Why does the paperclip resist moving when the jar starts moving?

A body at rest (paperclip) remains at rest until an unbalanced force (the cotton) moves it.

2 Why does the paperclip keep moving forwards when the jar comes to a rest?

A body in motion (paperclip) remains in motion until an unbalanced force (the cotton) stops it.

3 What happens to the paperclip when the jar is moving at a constant speed?

The paperclip moves at the same speed as the jar. This means it hangs straight down.

4 How do our bodies tell us we are accelerating, decelerating or travelling around a corner?

We feel unbalanced forces acting on one part of our body and the message gets passed to our brain. Our brain interprets this as acceleration, deceleration or travelling around the corner.

Experiment worksheet answers

7.4 An object in motion remains in motion until a force acts on it

Pages 162–163 and 222

Challenge 7.4B: How do you like your eggs?

Expected results

The hard-boiled egg will stop spinning when it is gently stopped and the fresh egg will continue to spin when it is gently stopped. The fresh egg is liquid inside and so inertia continues to spin the egg.

Discussion

1 How does the egg’s motion after you release your finger help you to predict whether the egg is hard-boiled or fresh? Open the shells (over a rubbish bin or sink) to see if you are correct.

A fresh egg will continue spinning after the finger is removed. A hard-boiled egg will remain still after the finger is removed.

2 Think about the inside of an egg and the motion of the shell and the egg itself while it is spinning. Think also of Newton’s first law. Describe what you did in terms of inertia.

The liquid inside the fresh egg will continue moving until an unbalanced force stops it. This unbalanced force is the friction of the inside of the egg shell.

Experiment worksheet answers

7.5 Force equals mass × acceleration

Pages 164–165 and 223

Experiment 7.5A: Resultant forces

Discussion

1 What is the difference between a force diagram and a vector diagram?

A force diagram shows the magnitude of a force, a vector diagram shows the magnitude and direction in three directional space of force, distance, speed or acceleration.

2 What does ‘net force’ mean?

The net force is the sum of all forces acting on an object.

Experiment worksheet answers

7.5 Force equals mass × acceleration

Pages 164–165 and 224

Experiment 7.5B: Accelerating masses

Discussion

1 How did increasing the mass on the trolley affect the acceleration of the trolley?

Force is inversely proportional to acceleration. This means as the mass increases, the acceleration decreases.

2 Relate your experiment to a real-life example.

Students’ answers will vary. For example the same force acting on a basketball and a heavy medicine ball will cause the lighter basketball to accelerate faster.

Conclusion

What is the relationship between mass and acceleration?



Experiment worksheet answers

7.6 Each action has an equal and opposite reaction

Pages 166–167 and 225

Experiment 7.6: Newton’s rocket

Discussion

1 Why does the balloon move forwards?

The air moving out the back of the balloon propels the balloon forward.

2 Draw a picture of the balloon rocket with all the forces that are acting on it.

The diagram should include the following forces: gravity pulling down, string pushing up, air pushing backwards, air pushing balloon forward.

3 Describe the action and reaction that occurs in the balloon rocket.

The air pushing backwards causes a forward force on the balloon rocket.

4 How would you expect the average speed to change if the balloon was inflated less? Explain.

The average speed will be less. A less inflated balloon will have less air moving out slower.

Experiment worksheet answers

7.7 Momentum is conserved in a collision

Pages 168–169 and 226

Experiment 7.7: Colliding trolleys

Discussion

1 When the trolleys are released, do they travel towards each other for the same period of time? Explain.

The trolleys travel towards each other for the same period of time because the journeys are of the same length.

2 Is the magnitude of the force acting on each trolley the same? Explain

The magnitude of the force acting on each trolley must be the same as the tension in the rubber bands is the force accelerating them.

3 If both trolleys come to a stop after the collision, what was the final total momentum of the ‘system’? Explain

Final total momentum is zero. If there is no velocity, then there is no momentum.

4 According to the last column of results, what was the initial total momentum of the ‘system’?

The initial total momentum should be zero as the momentum of each trolley should be equal in size but opposite in direction to the other trolley.

Conclusion

What did this experiment demonstrate about the total momentum before and after a collision?

The total momentum before a collision is the same as the total momentum after a collision.

Experiment worksheet answers

7.8 Work occurs when an object is moved or rearranged. Energy can be calculated.

Pages 170–171 and 227

Experiment 7.8: What if an elastic band was stretched further?

Discussion

1 Describe the relationship between the distance the elastic band was stretched and the distance the elastic band moved.

When the elastic band was stretched more, it moved a greater distance.

2 Where did the initial energy come from to stretch the elastic band?

From the person’s hand.

3 What type of energy did the elastic band have?

Elastic potential energy.

4 How much work was done when the elastic band was first stretched? ()

Students’ answers will vary.

5 If all the elastic potential energy was translated to kinetic energy, how much kinetic energy did the elastic band have when it left the ruler?

Students’ answers will vary.

6 What velocity did the elastic band have when it left the ruler? ()

Students’ answers will vary.

Experiment worksheet answers

7.9 Energy is always conserved

Pages 172–173 and 228

Challenge 7.9: Conservation in action

Student answers will vary.