# TRANSPORT
## *Learning Outcomes*

## Section 1 - On the Move

**People today travel further and faster than they ever did before. The economic growth of our country depends on efficient and safe forms of transport. In this section you will measure both steady and changing speeds and find out how to display speed and time on a graph.**

*At General level you should be able to:*

- ❑ 1. Describe an experimental method for measuring an average speed.
- ❑ 2. Carry out calculations using the relationship between time, distance and average speed.
- ❑ 3. Describe an experimental method for measuring an instantaneous speed.
- ❑ 4. Explain what is meant by *speed*.
- ❑ 5. Explain what is meant by *acceleration*.
- ❑ 6. Use the change in speed per unit time to calculate acceleration.
- ❑ 7. Draw speed-time graphs for
  (a) *steady speed*
  (b) *speeding up*
  (c) *slowing down*.
- ❑ 8. Describe the motion represented by a speed-time graph.
- ❑ 9. Use information from a speed-time graph to calculate acceleration when there is a single constant acceleration involved.

*At Credit level you should also be able to:*

- ❍ 10. Give examples where average speed is different from instantaneous speed.
- ❍ 11. Explain why the method of timing can affect the values obtained experimentally for instantaneous speeds.
- ❍ 12. Use information from a speed-time graph to calculate distance travelled.
- ❍ 13. In addition to ***9*** above, use information from a speed-time graph to calculate acceleration when there is more than one constant acceleration involved.
- ❍ 14. Carry out calculations using the relationship between initial speed ($u$), final speed ($v$), time ($t$) and uniform acceleration ($a$).

## Section 2 - Forces at Work

**The laws that govern movement have fascinated humans for centuries. People like Aristotle, Galileo and Newton have become famous for their work on motion, friction and gravity. Even today, our knowledge of motion and factors that affect it are being continually investigated, as we strive to go more quickly, more safely and more economically on this planet and also into space.**

**In this section, you will learn how to measure force, and to study the pull of gravity on objects. You will investigate friction and how it affects movement. You will then learn about Newton's First Law and how it applies to seat belts.**

*At General level you should be able to:*

- ❑ 1. Describe the effects of forces.
- ❑ 2. Describe the use of a Newton Balance to measure a force.
- ❑ 3. State that weight is a force, and that it is the Earth's pull on an object.
- ❑ 4. State the value of $g$ used to calculate weight on Earth.
- ❑ 5. State that the force of friction acts in the opposite direction to the direction of travel.
- ❑ 6. Describe and explain situations where we try to increase the force of friction.
- ❑ 7. Describe and explain situations where we try to decrease the force of friction.
- ❑ 8. Explain the term '*balanced forces*', and state what balanced forces are equivalent to.
- ❑ 9. State what happens to the speed of a vehicle if balanced forces or no forces act on it.
- ❑ 10. Explain why seat belts are required in cars by talking about the forces involved.
- ❑ 11. Describe what happens to the acceleration of a vehicle when the force on it is changed.

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❑ 12. Describe what happens to the acceleration of a vehicle when its mass is changed.

❑ 13. Carry out calculations involving the relationship between force ($F$), mass ($m$) and acceleration ($a$).

*At Credit level you should also be able to:*

❍ 14. Distinguish between mass and weight.

❍ 15. State that the weight per unit mass is called the *gravitational field strength*.

❍ 16. Carry out calculations involving the relationship between weight ($W$), mass ($m$) and gravitational field strength ($g$).

❍ 17. State *Newton's First Law*.

❍ 18. Explain the movement of objects by using Newton's first law

❍ 19. Carry out calculations involving the relationship between force ($F$), mass ($m$) and acceleration ($a$) in situations where more than one force is involved.

## Section 3 - Movement Means Energy

**Transport cannot move without a supply of energy. Energy is used in many different ways in all kinds of transport. During a journey energy will be transformed in a number of ways, and, if the vehicle is involved in a crash, energy has to be absorbed in a way which will not harm the passengers.**

**In this section, you will look at energy transformations in a car, look at how to measure work done, power and energy, and consider what happens to energy in a car crash.**

*At General level you should be able to:*

❑ 1. Describe the main energy changes when a vehicle
   (a) *accelerates*
   (b) *moves at a constant speed*
   (c) *brakes*
   (d) *goes up a slope*
   (e) goes down a slope.

❑ 2. State that work done is a measure of energy transferred.

❑ 3. Carry out calculations involving the relationship between work done ($W$), force ($F$) and distance ($d$).

❑ 4. Carry out calculations involving the relationship between power ($P$), work done ($W$) and time ($t$).

❑ 5. State that the gain in gravitational potential energy is the work done against gravity.

❑ 6. Carry out calculations involving the relationship between potential energy ($E_p$), mass ($m$), gravitational field strength ($g$) and height ($h$).

❑ 7. State how an increase in mass affects a moving object's kinetic energy.

❑ 8. State how an increase in speed affects a moving object's kinetic energy.

*At Credit level you should also be able to:*

❍ 9. Carry out calculations involving the relationship between kinetic energy ($E_k$), mass ($m$) and speed ($v$).

❍ 10. Carry out calculations involving kinetic energy ($E_k$), potential energy ($E_p$), work done ($W$), power ($P$) and using the principle of conservation of energy.