

- 1** Most of Ireland's energy needs are supplied by fossil fuels. Name three fossil fuels.
- 2** Which of these are energy forms?
sound pressure force weight electricity heat
- 3** Which of these six energy resources are renewable?
gas hydroelectricity oil coal wind tides
- 4** A model aircraft has its wings covered with solar panels to drive the propellers and to charge a battery. Copy and complete the following sentences to show the energy changes that take place in such an aircraft:
The solar cells change ____ energy into ____ energy. The battery stores ____ energy. As the propellers turn they change ____ energy into useful ____ energy. As the model aircraft gains height, it gains ____ energy. The model aircraft crashes into the ground. As it does so, it produces wasted heat and ____ energy.
- 5** Explain what is meant by a 'renewable' energy resource.
- 6** In what ways is the production of electricity in a fossil fuel power station and in a nuclear power station similar? In what ways are these power stations different?
- 7** Nuclear waste is currently vitrified (turned into a type of glass), stored in strong metal drums and kept deep underground. Why is this an unsatisfactory long-term solution?
- 8** Name the polluting gas that contributes to global warming, produced by burning fossil fuels.
- 9** Norway has complained that Britain is partly responsible for the destruction of the Norwegian habitat by acid rain. How might this have come about?
- 10** What are the arguments for and against installing a nuclear power station in Ireland?

- 11** Imagine you are a government scientist. Write about 100 words stating the advantages of having a nuclear power station rather than one that burns fossil fuels.
- 12** Why do you think Northern Ireland has not yet mined the lignite resources around Crumlin?
- 13** Do you think the Government's target to have 15% of our electricity production from renewable resources by 2020 is realistic? What can you and your family do to contribute?
- 14** Give three reasons for using wind farms to generate electricity.
- 15** The electricity companies say that electricity is a 'clean' fuel. Why is this statement misleading?
- 16** For each of the devices or situations shown below, use a flow diagram to show the main energy change that is taking place. The first has been done for you.

Device/situation	Input energy form		Useful output energy form
Microphone	sound energy	→	electrical energy
Electric smoothing iron	_____ energy	→	_____ energy
Loudspeaker	_____ energy	→	_____ energy
Coal burning in an open fire	_____ energy	→	_____ energy
A weight falling towards the ground	_____ energy	→	_____ energy
A candle flame	_____ energy	→	_____ energy and _____ energy
Battery-powered electric drill	_____ energy →	electrical energy	→ _____ energy

- 17** Competitors in the World's Strongest Man competition must throw a cement block of mass 100 kg over a wall 5.5 m high. How much work is done if the block just clears the top of the wall?
- 18** A man pushes a lawn mower with a force of 60 N. How much work does he do when he pushes the lawn mower 20 m?
- 19** The electrical energy used by a boiler is 1000 kJ. The useful output energy is 750 kJ.
- Calculate the efficiency of the boiler.
 - Suggest what might have happened to the energy wasted by the boiler.
- 20** Explain why the efficiency of a device can never be greater than 1 (or 100%).
- 21** A car engine has an efficiency of 0.28. How much input chemical energy must be supplied if the total output useful energy is to be 140 000 kJ?
- 22** The power of the motor in an electric car is 3600 W. How much electrical energy is converted into other energy forms in 5 minutes?
- 23** A crane can produce a maximum output power of 3000 W. It raises a load of mass 1500 kg through a vertical height of 12 m at a steady speed.
- What is the weight of the load?
 - How much useful work does the crane do lifting the load 12 m?
 - How long does it take the crane to raise the load 12 m?
 - At what speed will the load rise through the air?
- 24** A barrel of weight 1000 N is pushed up a ramp. The barrel rises vertically 40 cm when it is pushed 1 m along the ramp.
- Calculate how much useful work is done when the barrel is pushed 1 m along the ramp.
 - Pushing the barrel 1 m along the ramp requires 1200 J of energy. Calculate the efficiency of the ramp.

- 25** A communications satellite of mass 120 kg orbits the Earth at a speed of 3000 m/s. Calculate its kinetic energy.
- 26** The viewing platform at the Eiffel Tower in Paris is about 280 m from the ground. Find the gravitational potential energy of a rubber of mass 50 g on the viewing platform. Compare this to the kinetic energy of a 10 g bullet travelling at 150 m/s fired from a pistol. Comment on your answer.
- 27** An oil tanker has a mass of 100 000 tonnes. Its kinetic energy is 200 MJ. Calculate its speed.

(1 tonne = 1000 kg; 1 MJ = 1 megajoule = 1 000 000 J)

- 28** A ball of mass 2 kg falls from rest from a height of 5 m above the ground. Copy the table below and complete it to show the gravitational potential energy, the kinetic energy, the speed and the total energy of the falling ball at different heights above the surface.

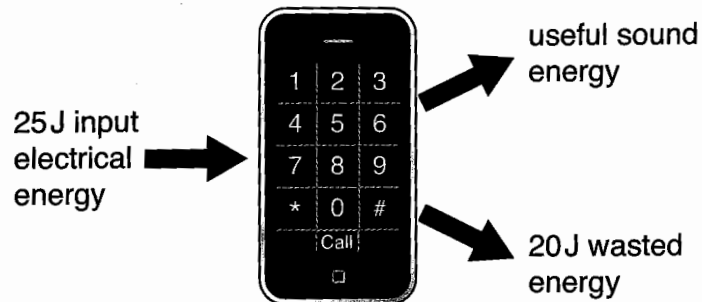
Height above ground in m	Gravitational potential energy in J	Kinetic energy in J	Total energy in J	Speed in m/s
5.0		0	100	0
4.0				4.47
	64			
1.8		64		
0.0	0			

- 29** A car of mass 800 kg is travelling at a steady speed. The kinetic energy of the car is 160 000 J. Show that the speed of the car is 72 km per hour.
- 30** On planet X, an object of mass 2 kg is raised 10 m above the surface. At that height, the object has a gravitational potential energy of 176 J. Details of three planets are given below. Which one of these three planets is most likely to be planet X?

Planet	Mercury	Venus	Jupiter
Gravitational field strength in N/kg	3.7	8.8	26.4

- 31** A bouncing ball of mass 200 g leaves the ground with a kinetic energy of 10 J.
- If the ball rises vertically, calculate the maximum height it is likely to reach.
 - In practice, the ball rarely reaches the maximum height. Explain why this is so.

- 32** The diagram shows energy transfers in a mobile phone.



- Use the figures on the diagram to calculate the phone's efficiency.
 - What principle of physics did you use to calculate the useful sound energy produced?
- 33** The diagram shows a rotary engine, which has an efficiency of 0.3.
- Calculate the amount of useful energy it produces when the input chemical energy is 2000 J.
 - 90% of the wasted energy is heat. What percentage of the input energy is lost as heat?

