Answers

Earth's Resources

Year 7 Science

Chapter 6

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1 Five of Earth's resources that are vital for human survival: Water, air, plants, animals, salt, soil.

2 Ten of Earth's resources that, while not vital for human survival, improve our quality of life: Oil, coal, gas, iron, copper, timber, cotton, wool, sand, limestone.

3 Five of Earth's resources that are used to increase wealth: Gold, diamonds, platinum, sapphire, ruby.

4 Three of Earth's resources that are inexhaustible (cannot be used up): Air, soil, salt water.

5 Three of Earth's resources that are extremely rare: Gold, diamonds, scandium, terbium.

6 'Less waste and more resources' suggests that the less we waste, the more resources that will be available for us to use.

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1 Renewable resources can be replaced relatively quickly.

2 Non-renewable resources are not able to be replaced or take a very long time to be replaced.

3 Label each of the following Earth's resources as either renewable or non-renewable

Oil - non-renewable	Sugar - renewable	Rice - renewable
Timber - renewable	Gas - non-renewable	Iron - non-renewable
Fish - renewable	Diamonds - non-renewable	Beef - renewable
Sand - non-renewable	Water - renewable	Coal - non-renewable

4 Is the tragedy of the commons an example of how a renewable resource can become a non-renewable resource? Grass is a renewable resource if given time to regrow after grazing. The tragedy of the commons suggests that severe continued over grazing will kill the grass and grass will then become a non-renewable resource.

5 Can you think of another resource, other than grass in a common paddock, that can be destroyed by the 'Tragedy of the Commons'? The tragedy of the commons could apply to many renewable resources such as timber. Severe use of timber could use up all timber stocks and it may then need 15 to 20 years to grow new stock making it a long time to be replaced - non-renewable. Fisheries would be another example.

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1 Australia's three major energy sources: Oil, coal, gas.

2 If 95% of Australia's energy comes from non-renewable sources, then 5% of Australia's energy comes from renewable sources.

3 Australia's major renewable energy source is biomass (wood and bagasse).

4 **a)** Coal is the energy source expected to reduce the most by 2035.

b) Gas is the energy source is expected to increase the most by 2035.

c) Given that a petajoule is the equivalent of 45 000 tonnes of coal, roughly how many tonnes of coal was used in 2010?

The graph suggests that 2200 petajoules of energy was supplied by coal in 2010

2200 petajoules equivalent to $2200 \times 45\,000 = 99\,000\,000$ tonnes of coal used in 2010

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1 Coal is called a 'fossil fuel' because it was formed from the remains of plants and animals.

2 Coal is described as non-renewable because will take a very long time to be replaced.

3 The major advantage of using coal as an energy source is that it is cheap.

4 The major disadvantage of using coal as an energy source is that it produces carbon dioxide and adds to the greenhouse effect.

5 The two main Earth resources needed for a coal power plant is coal and water

6 Open cut mining would be cheaper than underground mining.

7 High quality coal will burn easily. A coal fire in a large open cut mine is difficult to extinguish and a major strategy is to restrict oxygen from the fire by using water and foam for example. Coal fires are often left to burn themselves out.

p137

1 Oil is called a 'fossil fuel' because it was formed from the remains of plants and animals.

2 Oil is described as non-renewable because will take a very long time to be replaced.

3 The major advantage of using oil as an energy source is that it is a cheap fuel that is easy to extract and transport.

4 The major disadvantage is that burning oil produces carbon dioxide and adds to the 'greenhouse effect'.

5 I would expect the price of oil to rise steeply in the next 20 years as oil becomes scarce.

6 I would expect the current rate of use of oil to decrease over the next 20 years as oil becomes scarce.

7 Another 10 transport machines that use petrol or diesel for power: Cars, motorbikes, trains, ships, helicopters, buses, jet ski, tanks, tractors, air cushion amphibious vehicle.

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1 Natural gas is called a 'fossil fuel' because it was formed from the remains of plants and animals.

2 Gas is described as non-renewable because will take a very long time to be replaced.

3 Gas is easy to extract and to transport through pipelines. This makes gas a cheap fuel.

4 The major disadvantage of using coal as an energy source is that it produces carbon dioxide and adds to the greenhouse effect.

5 The Huntly power station uses water from the nearby river. A condition of use is that water returned to the river must be less than 25°C.

a) 25°C is set as the maximum temperature of returned water to avoid damage to the environment.

b) In hot weather, the 25°C condition would be difficult to achieve and would add cost to the production of electricity.

6 The Huntly power station contributes more than 50% of New Zealand's greenhouse carbon dioxide emissions. The Huntly power station may be able to reduce its carbon dioxide emissions by trapping the carbon dioxide and converting it to a solid form such as carbon.

Other reductions may be obtained by reducing the use of electricity throughout the country.

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1 Examples of biomass are wood, bagasse, and animal fats.

2 5 examples of biomass that may be found at the garbage dump are timber, paper, cardboard, waste foods, waste oil, waste grease.

3 Biomass energy is described as renewable because can be replaced in a short time (Waste products are continually being produced).

4 Three safety problems that need to be considered when using a methane generator: Methane gase is explosive and dangerous, the biomass used is a health hazard, the production of methane involves many types of bacteria including dangerous bacteria.

5 Which is the more damaging greenhouse gas, methane or carbon dioxide? Methane is more effective in trapping heat than carbon dioxide while there is considerably more carbon dioxide in the atmosphere.

6 Reorder the following renewable energy sources from most used to least used:

Biomass, Hydro energy, Wind energy, Solar energy, Geothermal energy, .

7 Biomass sources such as forests can take as long as 30/40 years to grow to maturity. Forests ar genrally considered to be renewable because there is a continual source of timber reaching maturity through controlled production. However, if very strong demand reduced the stocks and it would take 30/40 years for timber to become available then timber could be considered to be non-renewable.

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1 Hydro is the Greek word for water.

2 Hydro energy described as renewable because the water used at the power station is being replaced by rain within a comparatively short time.

3 Hydroelectric generation doesn't pollute the atmosphere. The water storage can also be used for irrigation and tourist attractions. The amount of hydroelectricity can also be increased and decreased as needed.

4 A hydroelectric power station is very expensive to build. It usually takes decades for a hydroelectric power station to become profitable.

5 Energy can also be taken from waves and tides as the waves and tides rise and fall.

6 The Basslink project cost around $800 million to complete in 2005.

a) The Basslink Interconnector enhances security of supply on both sides of Bass Strait; protecting Tasmania against the risk of drought-constrained energy shortages while providing Victoria and southern states with secure renewable energy during times of peak demand.

b) Connecting all electricity power stations in Australia be would allow even distribution of electricity over different peak times from the eastern states to the western states. It would also allow sharing of renewable energy from advantaged areas to all areas. It would also allow more stable energy supply and less disruption. However the cost of connection would be enormous.

7 Two reasons why Australia has relatively little hydroelectric power resources: Australia has plenty of cheap coal as a power source, Australia has a relatively small number of locations suitable for hydroelectric power stations.

p142

1 Wind energy is described as renewable because is replaced in a short time.

2 Wind turbines take up small areas of land and produce few pollutants. The wind is free. Wind energy is most useful in remote areas that aren't connected to a power grid.

3 The initial cost of setting up a wind turbine is high. Wind turbines are noisy and their electricity production is dependent on wind which can vary from dead calm to storm force.

4 17 000 watt-hours = 17 kilowatt-hours.

5 Calculate the daily electrical output of a 1000 watt wind turbine (assume 20 hours of useful wind).

Energy = 1000 watts ×20 hours
= 20 000 watt-hours
= 20 kilowatt-hours

6 Calculate the daily electrical output of five 5000 watt wind turbines (assume 15 hours of useful wind).

Energy = 5 × 5000 watts ×15 hours
= 375 000 watt-hours
= 375 kilowatt-hours

7 Assuming that the average family uses 15 kilowatt-hours of power daily, how many hours of useful wind would be needed to supply their daily electricity needs (assume a 1000 watt wind turbine).

Energy = 1000 watts × x hours
15 kilowatt-hours = 1000 watts × x hours
15 000 watt-hours = 1000 watts × x hours
15 hours = x hours Thus need 15 hours per day of useful wind.

p143

1 Solar energy is described as renewable because is being continually produced by the Sun.

2 Solar energy has many advantages. It is quiet, doesn't use water, and doesn't produce pollutants.

3 The major disadvantage is the relatively high initial cost.

4 Calculate the daily electrical output of ten 200 watt panels (assume 5 hours of sunlight).

Energy = 10×200 watts × 5 hours
= 10 000 watt-hours
= 10 kilowatt-hours

5 Calculate the daily electrical output of fifteen 230 watt panels (assume 8 hours of sunlight).

Energy = 15×230 watts × 8 hours
= 27 600 watt-hours
= 27.6 kilowatt-hours

6 The above shed appears to have one hundred and twenty 200 watt panels. Calculate the daily electrical output assuming 8 hours of sunlight.

Energy = 120×200 watts × 8 hours
= 192 000 watt-hours
= 192 kilowatt-hours

7 Assuming that the average family uses 15 kilowatt-hours of power daily, how many 200 watt panels would be needed to supply their daily electricity needs (assume 5 hours of sunlight).

Energy = 1000 watts × x hours
15 kilowatt-hours = x × 200 watts × 8 hours
15 000 watt-hours = x × 1600 watts-hours
9.375 = x Thus need ten 200 watt panels.

p144

2 Geothermal energy is described as non-renewable because the amount of geothermal energy appears to be unlimited.

2 Geothermal energy is free and can be unlimited.

3 Geothermal power stations can release some greenhouse gases such as carbon dioxide and methane. Geothermal water can also contain toxic chemicals such as mercury and arsenic.

4 The Australian Cooper Basin has the hottest rocks in the world, away from volcanoes and at economic depth.

5 How many homes could be supplied by a 10 megawatt geothermal power station (assume the average household uses 16 kilowatt-hours of electricity daily)?

Energy = x homes × 16 kilowatt-hours
10 000 kilowatts × 24 hours = x × 16 kilowatt-hours
240 000 kilowatt-hours = x × 16 kilowatt-hours
240 000 ÷ 16 = x
15 000 = x
A 10 megawatt geothermal power station would supply fifteen thousand homes.

6 How many homes could be supplied by a 20 megawatt geothermal power station (assume the average household uses 20 kilowatt-hours of electricity daily)?

Energy = x homes × 20 kilowatt-hours
20 000 kilowatts × 24 hours = x × 20 kilowatt-hours
480 000 kilowatt-hours = x × 20 kilowatt-hours
480 000 ÷ 20 = x
24 000 = x
A 20 megawatt geothermal power station would supply twenty-four thousand homes.

7 Assuming that the average home uses 16 kilowatt-hours of power daily, what capacity geothermal power station would be needed to supply a village of 500 homes?

Energy = 500 homes × 16 kilowatt-hours
x kilowatts × 24 hours = 8000 kilowatt-hours
x × 24 kilowatt-hours = 8000 kilowatt-hours
x = 8000 ÷ 24
x = 333
A 350 kilowatt geothermal power station would supply five hundred homes.

p145

1 5 kilowatt-hours = 5 watts × 60 ×60 seconds
= 18 000 watt-seconds
= 18 000 joules
= 18 kJ (kilojoules)

2 10 kilowatt-hours = 10 watts × 60 ×60 seconds
= 36 000 watt-seconds
= 36 000 joules
= 36 kJ (kilojoules)

3 12 kilowatt-hours = 12 watts × 60 ×60 seconds
= 43 200 watt-seconds
= 43 200 joules
= 43.2 kJ (kilojoules)

4 16 kilowatt-hours = 16 watts × 60 ×60 seconds
= 57 600 watt-seconds
= 57 600 joules
= 57.6 kJ (kilojoules)

5 Convert 20 kilowatt-hours to joules.

5 20 kilowatt-hours = 20 watts × 60 ×60 seconds
= 72 000 watt-seconds
= 72 000 joules
= 72 kJ (kilojoules)

p145

6 How much energy, in joules, is produced by a 5 watt solar panel in direct sunlight for 2 hours?

Energy = 5 watts × 2 hours
= 5 watts × 2 × 60 × 60 seconds
= 36 000 watt-seconds
= 36 000 joules
Energy = 36 kilojoules

7 How much energy, in joules, is produced by a 15 watt solar panel in sunlight for 5 hours?

Energy = 15 watts × 5 hours
= 15 watts × 5 × 60 × 60 seconds
= 270 000 watt-seconds
= 270 000 joules
Energy = 270 kilojoules

8 How much energy, in joules, is produced by a 250 watt solar panel in sunlight for 5 hours?

Energy = 250 watts × 5 hours
= 250 watts × 5 × 60 × 60 seconds
= 4 500 000 watt-seconds
= 4 500 000 joules
Energy = 4500 kilojoules

9 How much energy, in joules, is produced by a 20 watt wind turbine (assume 16 hours of useful wind)?

Energy = 20 watts × 16 hours
= 20 watts × 16 × 60 × 60 seconds
= 1 152 000 watt-seconds
= 1 152 000 joules
Energy = 1152 kilojoules

10 How much energy, in joules, is produced by five 1000 watt wind turbines (assume 18 hours of useful wind)?

Energy = 5 × 1000 watts × 18 hours
= 5000 watts × 18 × 60 × 60 seconds
= 324 000 000 watt-seconds
= 324 000 000 joules
Energy = 324 000 kilojoules

p146

1 Renewable resources can be replaced relatively quickly.

2 Non-renewable resources are not able to be replaced or take a very long time to be replaced.

3 Label each of the following Earth's resources as either renewable or non-renewable

Oil - non-renewable	Sugar - renewable	Rice - renewable
Timber - renewable	Gas - non-renewable	Iron - non-renewable
Fish - renewable	Diamonds - non-renewable	Beef - renewable
Sand - non-renewable	Water - renewable	Coal - non-renewable

4 Three of Earth's resources that are inexhaustible (cannot be used up): Air, soil, saltwater, geothermal energy.

5 'Less waste and more resources' suggests that the less we waste, the more resources that will be available for us to use.

6 Is the tragedy of the commons an example of how a renewable resource can become a non-renewable resource? Grass is a renewable resource if given time to regrow after grazing. The tragedy of the commons suggests that severe continued over grazing will kill the grass and grass will then become a non-renewable resource.

p146

1 Coal, oil, and natural gas are called fossil fuels because they were formed from the remains of plants and animals.

2 Coal, oil, and natural gas are described as non-renewable because will take a very long time to be replaced.

3 Uranium described as non-renewable because will take a very long time to be replaced.

5 The major advantage of using coal, oil, and natural gas as an energy source is that they are cheap.

4 The major disadvantage of using coal, oil, and natural gas as an energy source is that they produce carbon dioxide and add to the greenhouse effect.

5 The two main Earth resources needed for a coal power plant is coal and water

6 The major disadvantage of using uranium as an energy source is the production of very dangerous waste products.

7 Two major advantages of using uranium as an energy source are that small quantities of uranium can produce massive amounts of cheap energy through nuclear fission.

8 I would expect the price of coal, oil, and natural gas to rise steeply in the next 20 years as these fossil fuels become scarce.

p147

1 Mass = 1 000 000 × 1 gram
= 1 000 000 grams
= 1000 kilograms
= 1 tonne

2 Increase of 10% = \$100 + 10% of \$100
= \$100 + 0.1 × \$100
= \$100 + \$10
= \$110

Decrease of 10% = \$110 − 10% of \$110
= \$110 − 0.1 × \$110
= \$110 − \$11
= \$99

3 Calculate the volume of the cube of side 6 cm.
Volume = side × side × side = side^3
= (6 cm)^3
= 6 × 6 × 6 cm^3
= 216 cm^3

Calculate the volume of the cube of side 8 cm.
Volume = side × side × side = side^3
= (8 cm)^3
= 8 × 8 × 8 cm^3
= 512 cm^3

Calculate the volume of the cube of side 10 cm.
Volume = side × side × side = side^3
= (10 cm)^3
= 10 × 10 × 10 cm^3
= 1000 cm^3

Calculate the volume of the cube of side 12 cm.
Volume = side × side × side = side^3
= (12 cm)^3
= 12 × 12 × 12 cm^3
= 1728 cm^3

The balance will be balanced with the 12 cm cube on one side and the three other cubes on the other side.

p148

1 Biomass is biological material derived from living, or recently living organisms. Examples of biomass are wood, bagasse, and animal fats.

2 Biomass energy, hydro energy, wind energy, solar energy, and geothermal energy is described as renewable because it can be replaced in a short time or is inexhaustible.

3 Which is the more damaging greenhouse gas, methane or carbon dioxide? Methane is more effective in trapping heat than carbon dioxide while there is considerably more carbon dioxide in the atmosphere.

4 Reorder the following renewable energy sources from most used to least used:

Biomass, Hydro energy, Wind energy, Solar energy, Geothermal energy, .

5 Describe the advantages and disadvantages of using each of the following renewable energy sources:

Solar energy, Geothermal energy, Hydro energy, Biomass, Wind energy.

Advantages are that many of them are free and unlimited.

Disadvantages are that it is expensive to establish the production of energy from these sources.

6 How many homes could be supplied by a 10 megawatt geothermal power station (assume the average household uses 16 kilowatt-hours of electricity daily)?

Energy = x homes × 16 kilowatt-hours
10 000 kilowatts × 24 hours = x × 16 kilowatt-hours
240 000 kilowatt-hours = x × 16 kilowatt-hours
240 000 ÷ 16 = x
15 000 = x
A 10 megawatt geothermal power station would supply fifteen thousand homes.

7 How many homes could be supplied by a 20 megawatt geothermal power station (assume the average household uses 20 kilowatt-hours of electricity daily)?

Energy = x homes × 20 kilowatt-hours
20 000 kilowatts × 24 hours = x × 20 kilowatt-hours
480 000 kilowatt-hours = x × 20 kilowatt-hours
480 000 ÷ 20 = x
24 000 = x
A 20 megawatt geothermal power station would supply twenty-four thousand homes.

8 Assuming that the average home uses 16 kilowatt-hours of power daily, what capacity geothermal power station would be needed to supply a village of 500 homes?

Energy = 500 homes × 16 kilowatt-hours
x kilowatts × 24 hours = 8000 kilowatt-hours
x × 24 kilowatt-hours = 8000 kilowatt-hours
x = 8000 ÷ 24
x = 333
A 350 kilowatt geothermal power station would supply five hundred homes.

9 Calculate the daily electrical output of a 1000 watt wind turbine (assume 20 hours of useful wind).

Energy = 1000 watts × 20 hours
= 20 000 watts (or 20 kilowatts)
= 20 000 watts × 60 × 60 seconds
= 72 000 000 watt-seconds
Energy = 72 000 kilojoules

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10 Calculate the daily electrical output of ten 200 watt panels (assume 5 hours of sunlight).

Energy = 10×200 watts × 5 hours
= 10 000 watt-hours
= 10 kilowatt-hours

11 Two reasons why Australia has relatively little hydroelectric power resources: Australia has plenty of cheap coal as a power source, Australia has a relatively small number of locations suitable for hydroelectric power stations.

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1 b) **2** d) **3** c)

4 Assume a TV uses 650 joules of electrical energy.
400 joules goes to useful light energy,
150 joules goes to useful sound energy, and,

a) 50 joules goes to wasted heat energy.
b) 100 joules goes to wasted heat energy.
c) 50 joules goes to useful chemical energy.
d) 100 joules goes to useful chemical energy.

Answer = b)

p150

1 **a)** Solar energy shown on the graph because its use is too small to show on the graph.

b) I would expect the amount of energy sourced from renewable sources such as solar to increase as governments support the use of renewable energy. I would also expect the amount of renewable energy to increase as the costs of energy from non-renewable sources such as oil, coal, and gas to increase as they become rarer.

2 **a)** The family is using 0.5 kilowatts early in the morning when everyone would be expected to be asleep as energy is used to power fridges, air conditioners, and other devices on standby.

b) More energy used being used at 8 pm than at 8am as people use stoves and microwaves to cook dinner and take baths (More so than in the mornings).

c) Roughly estimate how many kilowatt-hours this family uses in a day.

A rough average is about 1.2 kilowatts over 24 hours = 28.8 kilowatt-hours

d) If electricity is $0.30 per kilowatt-hour, what is the electricity cost for this family for a quarter (3 months)?

Cost = 28.8 kilowatt-hours per day × $0.30 per kilowatt-hour × 90 days per quarter
= $777.60