Answers Energy Transfer

Year 9 Science Chapter 8

p199	**1** **Energy** is the ability to do work by producing movement. **2** Energy is measured in joules (J). **3** How many joules in? **a)** 1 kilojoule = 1000 J **b)** 1 megajoule = 1 000 000 J **c)** 1 gigajoule = 1 000 000 000 **4** Energy can exist in many different forms and chemical energy is an example. Other examples are nuclear energy, elastic energy, radiation energy, sound energy, gravitational energy, electrical energy, thermal (heat) energy, kinetic energy.. **5** Kinetic energy is the energy involved in movement. **6** Two examples of kinetic energy: A falling rock, a moving car. **7** As a rock falls it transfers gravitational potential energy into kinetic energy. **8** To become cooler, the lizard could move into the shade or move into water. **9** An organism that has a constant internal temperature is constantly using energy to maintain the constant temperature. A lizard, with a varying internal temperature, uses less energy because the energy is mostly obtained from the environment when the lizard needs more movement to hunt prey. **10** A large beaker of water takes longer to boil than a small beaker of water because more energy is needed to boil and thus more time needed to get the larger energy from the heating source.
p201	**1** Heat energy is a form of energy that is transferred between substances. Heat flows from hotter substances to colder substances. **2** The thermal energy of an object is the energy of the vibrating and/or moving molecules in the object. **3** The particle model is used to explain heat transfer and also how solids, liquids, and gases behave. **4** The particles of a solid vibrate and when heated vibrate faster, pushing each other further apart, causing expansion. **5** When a liquid is heated the particles vibrate faster and move faster causing expansion. Some particles have enough kinetic energy to break from the liquid. **6** 500 mL of warm water has more thermal energy than 400 mL of warm water at the same temperature?

p203	**1** The transfer of thermal energy from a hotter body to a colder body can happen by either conduction, convection, or radiation. **2** Thermal conduction is the transfer of heat energy within an object or between two objects that are in contact with each other. Conduction occurs in solids, liquids, and gases. **3** Solids, such as metals, are more conductive of heat energy than liquids or gases because the particles are closer together allowing transfer of energy by vibration and collision. **4** The handle of a metal spoon becomes warmer after the other end has been put in hot water because heat energy is conducted along the spoon. **5** A coat makes you feel warmer because it prevents the loss of thermal energy?
p205	**1** The transfer of thermal energy from a hotter body to a colder body can happen by either conduction, convection, or radiation. **2** Thermal convection is the transfer of thermal energy from one place to another by the movement of liquids or gases. **3** When heating water, the water particles at the bottom of the saucepan gain thermal energy by conduction from the vibrating particles in the metal base. The water particles at the base move faster, further, and take up more space. The expanded warmer water rises. Cooler, denser water moves into the space left by the rising warmer water forming a convection current. **4** When using a heater in a house, the particles of air around the heater gain energy from the heater, move faster and causing the air to expand. The warm air thus rises. Cooler, denser air moves into the space left by the rising warmer air forming a convection current. **5** Thermal convection can't happen in solids because the particles of the solid are unable to move freely. **6** Timber homes can lose thermal energy by convection as warm air escapes through small gaps in timber walls. The heat transfer may be reduced by closing the small gaps with a filler, or fill the walls of the home with insulation, or line the inside of the walls with sheets of material. **7** Indicate which method of heat transfer, conduction or convection, is relevant to each vacuum flask design element: **a)** Stopper made of insulating material - prevents conduction of thermal energy through the stopper material. The use of a stopper prevents loss of thermal energy through convection. **b)** A vacuum between the two flasks - prevents heat transfer through conduction.
p207	**1** The transfer of thermal energy from a hotter body to a colder body can happen by either conduction, convection, or radiation. **2** Thermal radiation is the transfer of heat energy from one place to another by electromagnetic waves. Thermal radiation is also known as infrared radiation. **3** Radiation is different to conduction and convection because radiation energy radiates outwards from a source, travels at high speed, and can travel through a vacuum. **4** Explain each of the following: **a)** Your hand will feel warmer when put in sunlight as thermal energy is radiated onto your hand from the Sun. **b)** Electric heaters have shiny reflectors behind them to reflect and radiate the thermal energy to the front of the heater rather than being absorbed at the back of the heater. **c)** A green house keeps the heat in because it traps the radiated thermal energy within the green house. The radiated energy passes through the glass and heats the material within the green house. The green house prevents heat loss through convection.

p209

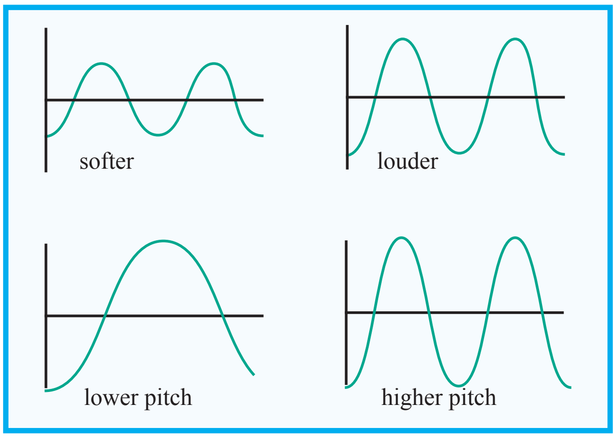
1 Examples of sound being produced when something vibrates.

- A vibrating string on a guitar produces a sound (Use your finger to stop the vibration and the sound stops).
- Your vocal cords vibrate and produce a sound when you hum (Put your hand on your throat and feel the vibrations).
- When struck, the casing on a bell vibrates to produce a sound (You can feel the vibrations in the bell).

2 The repeated vibration sends waves of compression and decompression away from the vibrating object.

3 Sound waves travel through a material, such as air, by particle-to-particle interaction. Sound is unable to pass through a vacuum because there are no particles.

4



p211

1 The sound from a starting pistol is heard 1.8 seconds after the smoke from the starting pistol is seen. What is the speed of sound, if the starting pistol was 600 metres away?

$$v = \frac{d}{t} = \frac{600\ m}{1.8\ s} = 333\ m/s$$

2 Calculate the speed of sound from the following investigation data:

a) distance = 450 m, time = 1.3 s

$$v = \frac{d}{t} = \frac{450\ m}{1.3\ s} = 346\ m/s$$

b) distance = 680 m, time = 2.0 s

$$v = \frac{d}{t} = \frac{680\ m}{2.0\ s} = 340\ m/s$$

3 The echo from a large wall, 50 m away, is heard 0.2 seconds after making a large clap. Calculate the speed of sound.

$$v = \frac{d}{t} = \frac{2 \times 50\ m}{0.2\ s} = 500\ m/s$$

4 Thunder is heard 15 seconds after the lightning was seen. How far away was the lightning? Assume that the speed of sound is 340 m/s.

$$v = \frac{d}{t} \quad thus\ d = vt = 340\ m/s \times 15\ s = 5.1\ km$$

5 Thunder is heard 19 seconds after the lightning was seen. How far away was the lightning? Assume that the speed of sound is 340 m/s.

$$v = \frac{d}{t} \quad thus\ d = vt = 340\ m/s \times 19\ s = 6.5\ km$$

6 Roughly how far will sound travel through air in 3 seconds?

$$v = \frac{d}{t} \quad thus\ d = vt = 340\ m/s \times 3\ s = 1\ km$$

p211

7 Convert each of the following from m/s to km/h:

a) 295 m/s
$$v = \frac{295\ m}{1\ s} = \frac{295 \times 60 \times 60\ km}{1 \times 1000\ h} = 1062\ km/h$$

b) 343 m/s
$$v = \frac{343\ m}{1\ s} = \frac{343 \times 60 \times 60\ km}{1 \times 1000\ h} = 1235\ km/h$$

c) 120 m/s
$$v = \frac{120\ m}{1\ s} = \frac{120 \times 60 \times 60\ km}{1 \times 1000\ h} = 432\ km/h$$

d) 55 m/s
$$v = \frac{55\ m}{1\ s} = \frac{55 \times 60 \times 60\ km}{1 \times 1000\ h} = 198\ km/h$$

e) 1500 m/s
$$v = \frac{1500\ m}{1\ s} = \frac{1500 \times 60 \times 60\ km}{1 \times 1000\ h} = 5400\ km/h$$

f) 34 m/s
$$v = \frac{34\ m}{1\ s} = \frac{34 \times 60 \times 60\ km}{1 \times 1000\ h} = 122\ km/h$$

g) 333 m/s
$$v = \frac{333\ m}{1\ s} = \frac{333 \times 60 \times 60\ km}{1 \times 1000\ h} = 1199\ km/h$$

h) 340 m/s
$$v = \frac{340\ m}{1\ s} = \frac{340 \times 60 \times 60\ km}{1 \times 1000\ h} = 1224\ km/h$$

p213

1 **Electromagnetic energy** describes all the different types of energies emitted by the Sun. These include radio waves, microwaves, visible light, and x-rays.

2 The electromagnetic spectrum is the range of all types of electromagnetic energy.

3 Radio waves, microwaves, visible light, x-rays, gamma rays, ultraviolet, microwaves.

4 Radio waves have the longest wavelength?

5 Gamma rays have the shortest wavelength?

6 1 nm = 1 nanometre = 1×10^{-9} metres

7 **a)** 650 nm = 650 × 1×10^{-9} = 6.5×10^{-9} m or 0.000 000 65 m
b) 530 nm = 530 × 1×10^{-9} = 5.3×10^{-9} m or 0.000 000 53 m
c) 470 nm = 470 × 1×10^{-9} = 4.7×10^{-9} m or 0.000 000 47 m

p215

1 A FM radio station (101.5 FM) transmits at a frequency of 101.5 MHz and a wavelength of 3.0 m. What is the speed of the radio wave?

v = fλ = 101.5 MHz × 3.0 m = 101 500 000 Hz × 3.0 m = 304 500 000 m/s or 3×10^{8} m/s

2 A FM radio station (97.5 FM) transmits at a frequency of 97.5 MHz and a wavelength of 3.1 m. What is the speed of the radio wave?

v = fλ = 97.5 MHz × 3.1 m = 97 500 000 Hz × 3.1 m = 302 250 000 m/s or 3×10^{8} m/s

3 An AM radio station (620 AM) transmits at a frequency of 620 kHz and a wavelength of 484 m. What is the speed of the radio wave?

v = fλ = 620 kHz × 484 m = 620 000 Hz × 484 m = 300 080 000 m/s or 3×10^{8} m/s

4 On the musical scale, A has a frequency of 440 Hz. What is the wavelength of A, in air, assuming the speed of sound to be 340 m/s?

$$\lambda = \frac{v}{f} = \frac{340\ m/s}{440\ Hz} = 0.77\ m$$

5 On the musical scale, B has a frequency of 494 Hz. What is the wavelength of B, in air, assuming the speed of sound to be 340 m/s?

$$\lambda = \frac{v}{f} = \frac{340\ m/s}{494\ Hz} = 0.69\ m$$

p215

6 Assume a wave reaches the beach every 10 seconds (f = 1/10 = 0.1 Hz ie one-tenth of a wave every second). If the distance between waves is 8 m, what is the speed of the waves?

$v = f\lambda = 0.1\ \text{Hz} \times 8\ \text{m} = 0.8\ \text{m/s}$

7 Assume a wave reaches the beach every 8 seconds (f = 1/8 = 0.125 Hz ie one-eighth of a wave every second). If the speed of the waves is 0.6 m/s what is the wavelength of the waves?

$$\lambda = \frac{v}{f} = \frac{0.6\ m/s}{0.125\ Hz} = 4.8\ m$$

8 The waves in a ripple tank have a wavelength of 2 cm and a speed of 15 cm/s. What is the frequency of the waves?

$$f = \frac{v}{\lambda} = \frac{0.15\ m/s}{0.02\ m} = 7.5\ m$$

p217

1 Speed of light in a vacuum = 3×10^8 m/s or 300 000 000 m/s

2 If sunlight takes 8 mins 17 secs to reach Earth, how far away is the Sun?

$d = vt = 3\times10^8\ \text{m/s} \times 497\ \text{s} = 1.5\times10^{11}\ \text{m}$ or 150 000 000 000 m

3 Light is fastest in air

4 An electromagnetic wave is considered to travel as an electric field and as a magnetic field at right angles to each other.

5 Electromagnetic energy or electromagnetic **Radiation** refers to the full spectrum of types of electromagetic radiation from gamma rays, X-rays, to ultraviolet and microwaves. Thermal radiation, a type of electromagnetic radiation, is a combination of infrared and visible light.

6 Thermal radiation may be partially or completely **absorbed** by the substance that it meets.

7 When radiation is absorbed by a substance, its energy is transferred to heat energy.

8 A transparent medium allows transmits most of the light through the medium.

A translucent medium allows some of the light through the medium and reflects the rest of the light.

An opaque medium allows either reflects or absorbs the light.

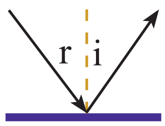
p219

1 If the surface of an object is smooth and flat, the light is reflected evenly and is called **specular reflection** (Specular means having the properties of a mirror).

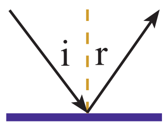
2 The **law of reflection** states that the angle of incidence is equal to the angle of reflection.

3 Which of the following shows the correct marking of the angle of incidence and the angle of reflection?

b)

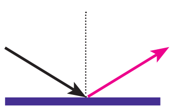


c)

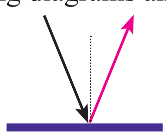


4 Copy each of the following diagrams and then add the reflected ray.

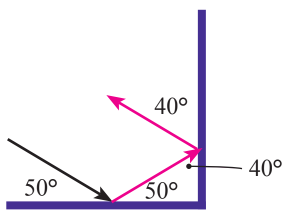
a)



b)



5 Two flat mirrors are arranged at right angles to each other as shown. Copy and complete the ray onto both mirrors. What are the angles of incidence and reflection to both mirrors?



p221	**1** **Electrical potential energy** is stored energy that has the potential to do work or cause movement due to movement of electrons. **2** Electrical energy can be changed into kinetic energy, light energy, chemical energy, sound energy, heat energy. **3** A mobile phone stores chemical energy in its battery. **4** A path that allows electrons to flow around it is called an **electric circuit**. All electric circuits consist of a source of electrical energy, a load which converts electrical energy to other forms of energy, and a conducting path such as wires. **5** If one of the globes in Circuit 2 blows, the second globe will not stay on. **6** If one of the globes in Circuit 3 blows, the second globe stay on. **7** If a light bulb in your house blows, the other light bulbs stay on. This suggests that the light bulbs in your house are wired in parallel.
p222	**1** A light globe in Circuit 4 above draws a current of 150 mA (0.15 amps) and has a voltage drop of 1.2 V. How much power is the globe using? P=Vi = 0.15 amps × 1.2 volts = 0.18 W **2** A house light bulb draws a current of 70 mA (0.07 amps) and has a voltage drop of 220 V. How much power is the light bulb using? P=Vi = 0.07 amps × 220 volts = 15.4 W **3** A 65 inch plasma TV draws a current of 0.73 amps and has a voltage drop of 225 V. How much power is the TV using. P=Vi = 0.73 amps × 225 volts = 164.25 W
p223	**1** **a)** **Current** measures the flow of electrons through a particular point in an electric circuit. Current (i) is measured in amperes (A) or amps. An ammeter is used to measure the current. **b)** **Voltage** meaures the change/difference in energy as electrical energy moves from one point to another. Voltage (V) is measured in volts (V). A voltmeter is used to measure the voltage. **c)** **Electric power** is the rate of transfer of electrical energy through a circuit. Electric power (P) is measured in watts (W). **2** A light globe in Circuit 4 above draws a current of 200 mA (0.2 amps) and has a voltage drop of 2.5 V. How much power is the globe using? P=Vi = 0.2 amps × 2.5 volts = 0.5 W **3** Convert each of the following to kilowatts: **a)** 350 watts = 0.35 kW **b)** 750 watts = 0.75 kW **c)** 2000 watts = 2.0 kW **d)** 1450 watts = 1.45 kW **4** **Energy efficiency** is using less energy to provide the same service. **5** Incandescant lights produce 5% light energy and rest (95%) of the input electrical energy is wasted as heat energy. Halogen or fluorescent lights are more efficient by producing 70% light nergy and 95% light energy respectively. **6** Calculate the cost of running a 200 watt computer for 10 hours at a charge of 42 cents per kWh. Cost = 0.2 kW × 10 h × 0.42 $/kWh = $0.84 **7** Calculate the cost of running a 2000 watt heater for 6 hours at a charge of 45 cents per kWh. Cost = 2 kW × 6 h × 0.45 $/kWh = $5.40 **8** Calculate the yearly cost of running a 250 watt computer for 8 hours a day, 5 days a week, at a charge of 40 cents per kWh. Cost = 0.25 kW × 8×5×52 h × 0.40 $/kWh = $208.00

p224

1 **Laser light** is pure light of one wavelength, with each wave in phase (coherent).

2 The coherent light from a laser can produce a very intense, precise, narrow beam that can travel long distances. The white light from a light bulb is a mixture of different colours, each with a different wavelength, and each of them out of phase (incoherent).

3 Lasers are used to **scan barcodes**. The black strips of the barcode absorb the laser light from the scanner, while the white strips of the barcode reflect the laser light. The reflected pattern is decoded by an attached computer to identify the barcode's product.

4 Lasers are used to precisely **measure distances** in thousands of applications. A laser rangefinder measures the time taken for a laser beam to reach the target and to be reflected from the target. The rangefinder then calculates the distance. Lasers can be used by aerial drones to produce accurate land surveys.

5 Lasers have hundreds of uses: Fibre-optic communication, laser surgery, laser eye treatments, laser skin treatments, laser rocket defence, laser missile guidance, laser targetting, laser light displays, laser printers, laser welding, laser metal cutters, laser fabric cutters, CD and DVD players, laser pointers, scan barcodes, measure distance.

p225

1 Wireless technology is a way of transmitting information without wires. With wireless technology, information is carried on electromagnetic waves at very high speeds.

2 The types of electromagnetic radiation that are suitable for carrying information are:

☞ Radio waves (TV, radio, radar, WiFi)

☞ Microwaves (mobile phones)

☞ Infra-red waves (TV remote control)

3 Microwaves need line-of-sight, with no objects in the way, to weaken the signal.

4 Radio waves can cary information long distances by bouncing off the ionosphere and thus reaching over oceans. Other types of radio waves can bend over hills and mountains.

5 Microwaves are best for transmitting to and from satellites because microwaves can pass through the ionosphere.

p228

1 **Energy** is the ability to do work by producing movement.

2 Energy is measured in joules (J).

3 How many joules in?

a) 1 kilojoule = 1000 J

b) 1 megajoule = 1 000 000 J

c) 1 gigajoule = 1 000 000 000

4 Energy can exist in many different forms and chemical energy is an example. Other examples are nuclear energy, elastic energy, radiation energy, sound energy, gravitational energy, electrical energy, thermal (heat) energy, kinetic energy..

5 A large beaker of water takes longer to boil than a small beaker of water because more energy is needed to boil and thus more time needed to get the larger energy from the heating source.

6 Heat energy is a form of energy that is transferred between substances. Heat flows from hotter substances to colder substances.

7 The thermal energy of an object is the energy of the vibrating and/or moving molecules in the object.

8 The particle model is used to explain heat transfer and also how solids, liquids, and gases behave.

9 The particles of a solid vibrate and when heated vibrate faster, pushing each other further apart, causing expansion.

10 When a liquid is heated the particles vibrate faster and move faster causing expansion. Some particles have enough kinetic energy to break from the liquid.

11 When a gas is heated the particles vibrate faster and move faster into open space. The gas expands as the space between the molecules get larger.

12 When a liquid is heated the particles vibrate faster and move faster causing expansion. If sufficient heat energy is applied, some particles will have enough kinetic energy to break from the liquid and vibrate and move freely and be classified as a gas..

13 600 mL of warm water has more thermal energy than 300 mL of warm water at the same temperature?

p229

1 The transfer of thermal energy from a hotter body to a colder body can happen by either conduction, convection, or radiation.

2 Thermal conduction is the transfer of heat energy within an object or between two objects that are in contact with each other. Conduction occurs in solids, liquids, and gases.

3 Solids, such as metals, are more conductive of heat energy than liquids or gases because the particles are closer together allowing transfer of energy by vibration and collision.

4 A **thermal insulator** is a material that does not easily allow thermal energy to be transferred within the material. Non-metals and gases are usually good insulators.

5 Thermal convection is the transfer of thermal energy from one place to another by the movement of liquids or gases.

6 When heating water, the water particles at the bottom of the saucepan gain thermal energy by conduction from the vibrating particles in the metal base. The water particles at the base move faster, further, and take up more space. The expanded warmer water rises. Cooler, denser water moves into the space left by the rising warmer water forming a convection current.

7 When using a heater in a house, the particles of air around the heater gain energy from the heater, move faster and causing the air to expand. The warm air thus rises. Cooler, denser air moves into the space left by the rising warmer air forming a convection current.

8 Thermal convection can't happen in solids because the particles of the solid are unable to move freely.

9 Indicate which method of heat transfer, conduction or convection, is relevant to each vacuum flask design element:
a) Stopper made of insulating material - prevents conduction of thermal energy through the stopper material. The use of a stopper prevents loss of thermal energy through convection.
b) A vacuum between the two flasks - prevents heat transfer through conduction.

10 Thermal radiation is the transfer of heat energy from one place to another by electromagnetic waves. Thermal radiation is also known as infrared radiation.

11 Radiation is different to conduction and convection because radiation energy radiates outwards from a source, travels at high speed, and can travel through a vacuum.

12 **a)** Your hand will feel warmer when put in sunlight as thermal energy is radiated onto your hand from the Sun.
b) Electric heaters have shiny reflectors behind them to reflect and radiate the thermal energy to the front of the heater rather than being absorbed at the back of the heater.

p230

1 Examples of sound being produced when something vibrates.
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- When struck, the casing on a bell vibrates to produce a sound (You can feel the vibrations in the bell).

2 The repeated vibration sends waves of compression and decompression away from the vibrating object.

3 Sound would be expected to travel faster through water than air because the particles of water are closer together and more able to conduct waves of compression and decompression.

4 Sound waves travel through a material, such as air, by particle-to-particle interaction. Sound is unable to pass through a vacuum because there are no particles.

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p230

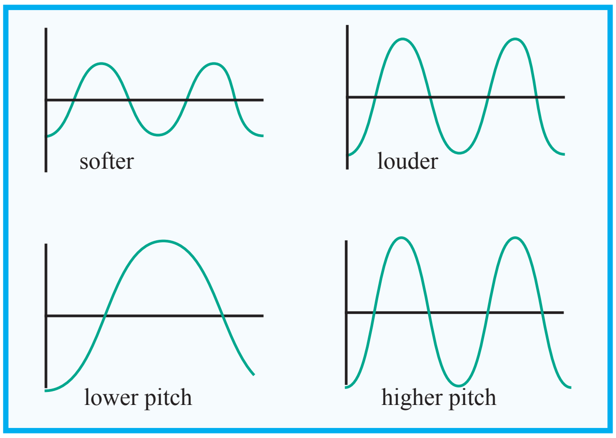
7 The echo from a large wall, 50 m away, is heard 0.2 seconds after making a large clap. Calculate the speed of sound.

$$v = \frac{d}{t} = \frac{2 \times 50\ m}{0.2\ s} = 500\ m/s$$

8 Thunder is heard 15 seconds after the lightning was seen. How far away was the lightning? Assume that the speed of sound is 340 m/s.

d = vt = 340 m/s×15 s = 5100 m = 5 km

9



p231

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2 The electromagnetic spectrum is the range of all types of electromagnetic energy.

3 Radio waves, microwaves, visible light, x-rays, gamma rays, ultraviolet, microwaves.

4 The wavelength is the distance between two successive waves. Wavelength is given the symbol λ (lambda) and is measured in metres (m).

5 Radio waves have the longest wavelength?

6 Gamma rays have the shortest wavelength?

7 1 nm = 1 nanometre = 1×10^{-9} metres

8 **a)** 650 nm = 650 × 1×10^{-9} = 6.5×10^{-9} m or 0.000 000 65 m
b) 530 nm = 530 × 1×10^{-9} = 5.3×10^{-9} m or 0.000 000 53 m
c) 470 nm = 470 × 1×10^{-9} = 4.7×10^{-9} m or 0.000 000 47 m

9 A FM radio station (101.5 FM) transmits at a frequency of 101.5 MHz and a wavelength of 3.0 m. What is the speed of the radio wave?

v = fλ = 101.5 MHz × 3.0 m = 101 500 000 Hz × 3.0 m = 304 500 000 m/s or 3×10^{8} m/s

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12 On the musical scale, A has a frequency of 440 Hz. What is the wavelength of A, in air, assuming the speed of sound to be 340 m/s?

$$\lambda = \frac{v}{f} = \frac{340\ m/s}{440\ Hz} = 0.77\ m$$

p232

1 Speed of light in a vacuum = 3×10^8 m/s or 300 000 000 m/s

2 If sunlight takes 8 mins 17 secs to reach Earth, how far away is the Sun?

$d = vt = 3\times10^8$ m/s $\times$ 497 s = 1.5×10^{11} m or 150 000 000 000 m

3 Light is fastest in air

4 An electromagnetic wave is considered to travel as an electric field and as a magnetic field at right angles to each other.

5 Electromagnetic energy or electromagnetic **Radiation** refers to the full spectrum of types of electromagetic radiation from gamma rays, X-rays, to ultraviolet and microwaves. Thermal radiation, a type of electromagnetic radiation, is a combination of infrared and visible light.

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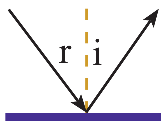

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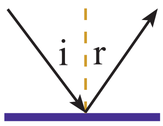
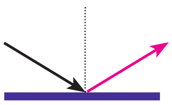
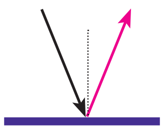


12 Copy each of the following diagrams and then add the reflected ray.

a)



b)



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1 http://www.scientificpsychic.com/mind/astronaut.html " Well, actually, in Skylab we did something similar to that. But on Apollo the urine then would go outside, and you'd have to heat the nozzle because, of course, it instantly flashes into ice crystals. And, in fact, I told Stewart this, the most beautiful sight in orbit, or one of the most beautiful sights, is a urine dump at sunset, because as the stuff comes out and as it hits the exit nozzle it instantly flashes into ten million little ice crystals which go out almost in a hemisphere, because, you know, you're exiting into essentially a perfect vacuum, and so the stuff goes in every direction, and all radially out from the spacecraft at relatively high velocity. It's surprising, and it's an incredible stream of ... just a spray of sparklers almost. It's really a spectacular sight. At any rate that's the urine system on Apollo."

2 As every statement is false, convert each statement into true statements, and number each statement:

Ann: 1) One of us took the painting. 2) The painting was gone when I left.

Bob: 3) I arrived first, third, or fourth. 4) The painting was still here.

Chuck: 5) I arrived first, second, or fourth. 6) The painting was gone when I arrived.

Tom: 7) Whoever stole the painting arrived after me. 8) The painting was still here.

Ann took the painting

3 1x4 + 2x3 = 10, 2x5+4x3 = 22, 3x6+4x5 = **38**

p234	**1** **Electrical potential energy** is stored energy that has the potential to do work or cause movement due to movement of electrons. **2** Electrical energy can be changed into kinetic energy, light energy, chemical energy, sound energy, heat energy. **3** If one of the globes in Circuit 1 blows, the second globe will not stay on. **4** If one of the globes in Circuit 2 blows, the second globe stay on. **5** If a light bulb in your house blows, the other light bulbs stay on. This suggests that the light bulbs in your house are wired in parallel. **6** a) Current measures the flow of electrons through a particular point in an electric circuit. Current (i) is measured in amperes (A) or amps. An ammeter is used to measure the current. b) Voltage meaures the change/difference in energy as electrical energy moves from one point to another. Voltage (V) is measured in volts (V). A voltmeter is used to measure the voltage. c) Electric power is the rate of transfer of electrical energy through a circuit. Electric power (P) is measured in watts (W). **7** The light globes in Circuit 1 above draw a current of 300 mA (0.3 amps) and have a voltage drop of 5 V. How much power are the globes using? P=Vi = 0.3 amps × 5 volts = 1.5 W **8** A 65 inch plasma TV draws a current of 0.82 amps and has a voltage drop of 230 V. How much power is the TV using. P=Vi = 0.82 amps × 230 volts = 188.6 W **9** Convert each of the following to kilowatts: **a)** 650 watts = 0.65 kW **b)** 980 watts = 0.98 kW **c)** 3000 watts = 3.0 kW **d)** 1270 watts = 1.27 kW **10** Calculate the cost of running a 2000 watt heater for 10 hours at a charge of 40 cents per kWh. Cost = 2 kW × 10 h × 0.40 $/kWh = $8.00
p235	**1** c) **2** c) **3** d) **4** a)
p236	**1** **a)** A light bulb in a circuit with a battery - Chemical energy to light energy. **b)** A falling granite rock - Gravitational energy to kinetic energy. **c)** A plucked guitar - Kinetic energy to sound energy. **d)** A lizard sunning itself in the Sun - Thermal energy to chemical energy. **e)** A bolt of lightning - Electrical energy to light energy. **2** Match each of the following sounds with their wave shapes. **a)** A loud high note - C **b)** A soft, high note - B **c)** A loud, low note - A **d)** A soft, low note - D **3** Use a blownup balloon to detect sound in front of a radio. Vibrations, kinetic energy, can be felt in the balloon in front of the radio but not behind. Touching the speaker of the radio senses the vibration, kinetic energy, of the speaker cone. The vibration, kinetic energy, of the air particles is difficult to see. **4** A house light bulb draws a current of 70 mA (0.07 amps) and has a voltage drop of 220 V. How much power is the light bulb using? P=Vi = 0.07 amps × 220 volts = 15.4 W **5** Total cost of running a 25 watt compact fluorescent light bulb (cost of $5) for 8000 hours $\text{Total}_{\text{fluorescent}}$ = $5 + 0.025 kW × 8000 h × 0.42 $/kWh = $89 Total cost of running a 60 watt incandescent light bulb (cost of $1 and last for 1000 hours) fo 8000 hours. $\text{Total}_{\text{incandescent}}$ = 8 × $1 + 0.06 kW × 8000 h × 0.42 $/kWh = $209.60 The total cost of using an incandescent light bulb is more than double the cost of using a fluorescent light bulb for 8000 hours.

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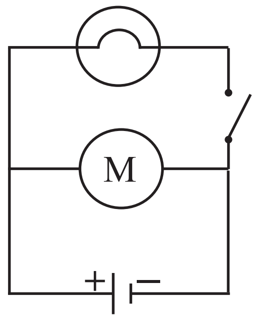
6 Explain each of the following:

a) We feel heat energy from the Sun. Thermal energy from the Sun is radiated onto our bodies and transferred into heat energy.

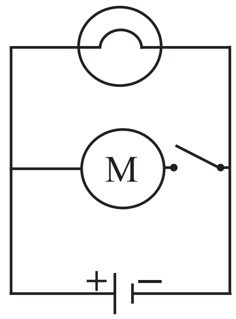
b) Houses in hot countries are often painted white to reduce the transfer of radiated thermal energy from the Sun into heat energy. The white reflects more of the radiated thermal energy than other colours.

c) Artificial satellites are highly polished so as to reflect as much radiated thermal energy from the Sun as possible to try to reduce heating of the satellite.

7 **a)** Turn the light bulb on but not the motor.



b) Turn on the motor but not the light bulb.



c) Turn on both the light bulb and the motor.