b) Energy transmitted through waves, such as solar energy *Radiant energy*

c) Energy you feel when you hold a hot cup of coffee *Thermal energy*

d) Energy in a molecule of natural gas *Chemical energy*

23. We say that energy is never created or destroyed. However, a glass of hot water cools down after some time because it loses its thermal energy. What happened to the energy in the water? *When a body loses energy, one or more other bodies gain the same amount of energy. In this case, the energy was first transferred to the container holding the hot water, then to the surrounding air.*

24. When we build a wood fire, the chemical energy in the wood molecules is released during combustion. It then transforms into two other forms of energy. What are they? Explain your answer. *When we build a wood fire, the chemical energy is transformed into radiant energy (the light emitted by the fire) and thermal energy (the heat produced).*

Section 4 • Fluids

Student textbook, pages 289 and 290

Pressure (*pages 280 to 286*)

1. *a)* What is a fluid? *A fluid is a substance that has no defined form and can flow in all directions.*

b) What are the different states of matter of fluids? *Liquids and gases*

c) Name two fluids that are present in the human body. *Blood, urine, sweat, sebum, etc.*

2. *a)* What is pressure? *Pressure is the measurement of force exerted on a surface.*

b) What formula is used to measure pressure?

$$Pressure = \frac{Force}{Area}$$

3. *a)* Pressure can be measured in newtons per square metre (N/m^2). What is the equivalent of N/m^2 in the international metric system? *1 Pascal (1 Pa)*

b) Name two other units used to measure pressure. *Kilopascals (1 kPa), millimetres of mercury (mm Hg), atmospheres (atm)*

c) A patient has a systolic blood pressure of 120 mm of Hg. Convert this reading into kPa. *16 kPa*

4. Pressure varies with the force exerted and the surface area upon which this force is applied. Describe the relationship between pressure and the following:

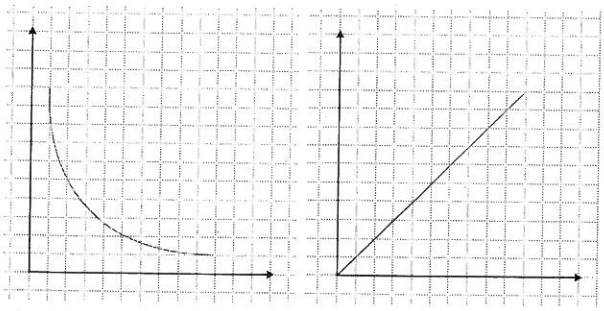
a) Applied force *The change in pressure is directly proportional to the applied force.*

b) The surface area upon which force is applied *The change in pressure is inversely proportional to the area on which the force is applied.*

5. In the following two diagrams:

a) Which one represents the change in pressure as a function of the surface area upon which force is exerted? *A*

b) Which one represents the change in pressure as a function of the force applied? *B*



A B

6. A person of average size is walking in high heels on a wooden surface. In the following scenarios, indicate whether the pressure exerted by the shoe heels on the wood would be greater or lesser, and why (identify which factor was changed, and how):

   a) The person wearing the shoes is relatively heavy. *The pressure will be higher because the applied force has increased.*

   b) The person is wearing shoes with thicker (less pointed) heels. *The pressure will be lower because the surface area on which the force is exerted is larger.*

7. A standard rectangular aquarium filled with 75 L of water exerts a pressure of 5 kPa on the base upon which it is sitting. What would the value of the pressure be if:

   a) The same aquarium is kept, but on a base that is three times smaller? *The pressure would be three times higher, or 15kPa.*

   b) The base is the same size, but the aquarium is only half full, so that its weight is reduced by half? *The pressure would be half, or 2.5 kPa.*

8. Referring to the particle theory, explain what causes water to exert pressure on the walls of the container it is held in. *According to the particle theory, the particles of fluids are constantly moving and collide with each other and with the walls of the container. When the particles collide with the walls of the container, they exert a force or pressure. The more collisions or contacts with the walls of the container, the greater the pressure exerted by the fluid.*

9. The atmospheric pressure is kept much lower in laboratories where dangerous micro-organisms are manipulated than in other rooms of the same building. Knowing that the micro-organisms can spread through the air, and drawing on what you know about how fluids move through diffusion, explain why this helps to keep the building safe for the workers there. *Since gaseous fluids always move from an area of higher pressure to an area of lower pressure, the air will tend to move into the laboratory rather than out of it, which reduces the chances that the micro-organisms will escape from the room.*

Compressible and Incompressible Fluids (*pages 286 and 287*)

10. *a)* What is compressibility? *Compressibility is the capacity to decrease in volume when a force is applied.*

    b) What types of fluids are compressible? *Gases*

    c) What types of fluids are incompressible? *Liquids*

11. What explains the difference between the compressibility of gases and that of liquids? *There are many empty spaces between the particles of a gas; when they are compressed, they get closer to each other and occupy a smaller volume. There is much less empty space between the particles of a liquid.*

12. When force is exerted on a compressible fluid, its volume is reduced. What happens when force is exerted on an incompressible fluid? *The force is transmitted from one particle to another inside the substance. This phenomenon causes the fluid to flow out of its container or move through a tube or a conduit.*

13. Name one way in which the compressibility of particular fluids is useful in our lives today. *We can store large volumes of gas in small spaces, such as in compressed-air tanks. Other possible answers.*

The Relationship Between Pressure and Volume of Compressible Fluids (pages 287 to 289)

14. Describe the relationship between the volume of a compressible fluid and the pressure it exerts. *At a constant temperature, the pressure of a given quantity of gas varies inversely with the volume occupied by the gas and vice versa.*

15. *a)* Describe the change in volume of a gas when its pressure is quadrupled. *The volume will be four times smaller.*

    b) Describe the change in gas pressure when its volume is doubled. *The pressure will be half as strong when its volume is doubled.*

16. A compressed-air tank contains 15 L of air at a pressure of 20 000 kPa.

    a) If you wanted to compress this gas down to a volume of 5 L, how much pressure would you have to exert? *The volume would be three times smaller; therefore, the pressure exerted would have to be three times higher, or 60 000 kPa.*

    b) If you brought the quantity of air contained in the tank to a normal atmospheric pressure (around 100 kPa), what volume would the gas take up? *The pressure would be 200 times weaker; therefore, the volume would be 200 times larger, or 3000 L.*

Section 5 • Waves

Student textbook, pages 313 and 314

Types of Waves (pages 294 and 295)

1. True or false?

    a) A wave carries energy from one point to another. *True*

    b) A wave transports matter from one point to another. *False*

    c) Mechanical waves and electromagnetic waves can move through matter. *True*

    d) Mechanical waves and electromagnetic waves can move through a vacuum. *False; mechanical waves cannot move through a vacuum.*

The Characteristics of Waves (pages 296 to 298)

2. What am I?

    a) A wave with a deformation running parallel to the direction of its propagation *Longitudinal wave*

    b) The highest point in a wave *Crest*

    c) The distance between two identical deformations *Wavelength*

    d) The maximum height attained by a wave at its equilibrium point *Amplitude*