

Chapter 9

(9.1)

Tropical climates are intense storms that begin over warm oceans in tropical regions and are accompanied by heavy rain and strong winds. It results in landslides.

Earthquakes happen when a plate slides over or against another plate, the force exerted between the two plates may result in a great amount of energy released.

Volcanic eruption is when a great amount of energy stored within earth is released as heat, light and kinetic energy of magna. It causes serious damage to nearby towns and villages.

Tsunami is when earthquakes and volcanic eruptions that occur beneath the ocean become strong enough to trigger a series of powerful waves. These powerful waves are also known as tsunamis.

(9.2)

There are two types of forces

- Contact force
- Non-contact forces

-Contact forces are forces acting between two objects that are in physical contact with each other. Examples of contact forces are **friction** and **elastic force**.

Friction is the force that opposes motion between two surfaces in contact. It is the force that allows us to hold onto things without dropping them.

To increase friction :

1) climbers use chalk as chalk absorbs moisture on their hands, which increases and improves their grip on the rock wall.

2) They also wear shoes that are made of a special type of rubber to increase friction. This allows them to push onto the footholds firmly and climb up the rock wall.

Elastic force is the force acting on a stretched or compressed elastic object to return it to its original state. When an elastic material is stretched or compressed, it resists the change in shape by exerting a force in the opposite direction.

(Eg) Climbers use climbing ropes that can stretch and exert elastic force. When a climber fall, the rope stretches and the elastic force exerted increases. This reduces the impact by the climber when he falls.

-Non-contact forces are forces acting between two objects that are not touching each other. Examples of non contact forces are **gravitational force** and **magnetic force**.

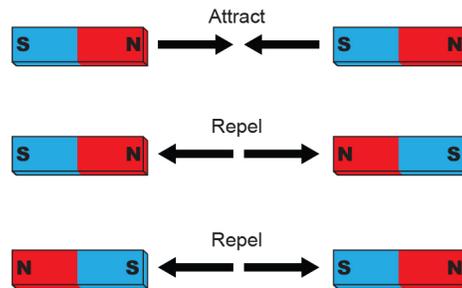
Gravitational force is a force that attracts two objects towards each other.

When a planet exerts gravitational force on an object and pulls it towards its centre, the object is known to have weight. Gravitational force keeps the moon orbiting around Earth Earth's gravitational force pulls all things towards its centre. Thus, if a rock climber falls, he will fall towards the ground.

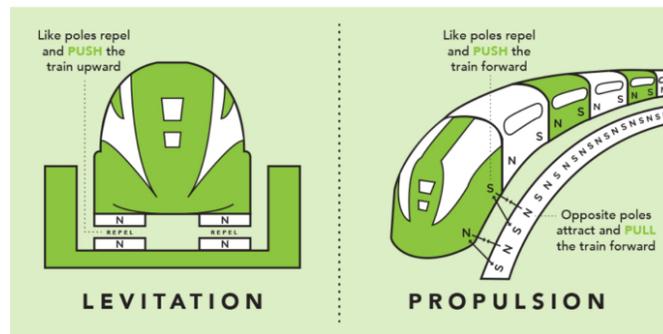
(Eg) Singapore Armed Forces Parachute Team, also known as the Red Lions, fall from a height of more than 3000 metres. As the skydivers move through the air, they have to steer themselves against strong winds coming from all directions. Gravitational force pulls them down towards Earth's surface.

Magnetic force is another type of non-contact force, It is the force exerted between a magnet and another magnetic material such as iron or steel. Magnetic force also exists between two magnets. Every magnet has a north pole and a south pole.

When unlike poles are brought close to each other, they pull together due to the magnetic force of attraction. When like poles are brought close to each other, they push apart due to the magnetic force of repulsion.



(Eg) A Maglev train works on the principle of magnetic repulsion between the train and the track. As the Maglev train travels on the track, the magnetic force of repulsion lifts it slightly above the track. This greatly reduces the friction between the train and the track, allowing the train to travel at a higher speed.



^^comparison between mass and weight

	Weight	Mass
What is it?	Gravitational force exerted on an object	Amount of matter in an object
How does it change? (1)	May change with location	Remains constant regardless of location
What is the SI unit?	Newton (N)	Kilogram (Kg)
What can be used to measure it? (2)	Spring balance	Electronic balance

(1)

Bag of rice on earth

Mass = 10kg

Weight = 100N

Bag of rice on the moon

Mass = 10kg

Weight = 16N



From above, you can see that the mass of the bag of rice remains the same in both the earth and the moon. However, less gravitational force acts on the bag of rice on the moon. Hence the bag of rice has a smaller weight on the moon on earth.

(2) We can measure forces by using a spring balance. The spring in a spring balance stretches when a force pulls on it. The weight of an object can be read directly off the scale on the spring balance. We can also use a spring balance to measure the amount of force due to a pull.

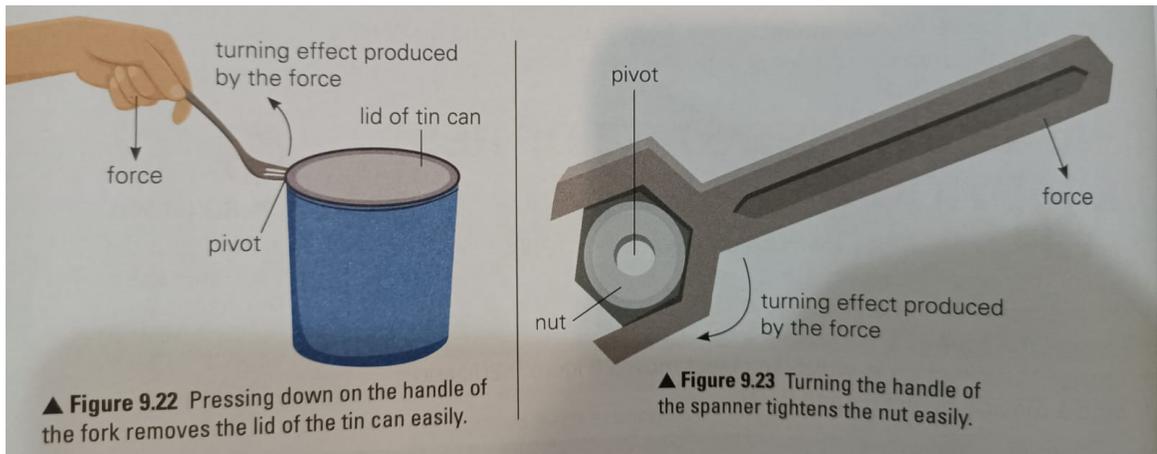
^^net weight = how heavy an object is

(9.3)

-The transfer of energy between objects can cause changes in the state of rest or motion of an object. It can :

- Move a stationary object
- Change the speed of an object
- Change the direction in which an object moves
- Stop a moving object
- Change the size/ or shape of an object
- Changes due to the turning effect of a force on an object (1)
- Change pressure on an object (2)

(1) A force applied on an object can cause a turning effect about a fixed point called the pivot. This turning effect can help us to carry out an action with little force, such as removing the lid of a tin can or tightening nut.



(2) Pressure is an effect of force acting on an object.

When we carry a backpack, it exerts a pressure on our shoulders. The amount of pressure depends on whether we carry the backpack using one or two straps, and how much the contents of our backpack weigh.



$$\text{Pressure} = \text{Force} / \text{Area}$$

[N / m² = pascal (Pa)] - unit

Examples of pressure in everyday life :



-An injection needle needs to be very sharp so that the area of contact of the needle with the skin is very small. When we apply a force on the needle, a high pressure allows the sharp needle to pierce the skin easily.

-The heel of a high-heeled shoe has a smaller area of contact with a surface than the heel of a sneaker. If a woman wearing high-heeled shoes steps on a mobile phone screen, the screen will likely crack due to the high pressure exerted on it. However, if she is wearing sneakers, the screen may not crack due to a lower pressure exerted on it.



-WATER PRESSURE-

There is a higher pressure acting on our body as we go deeper underwater, making it harder to go down.

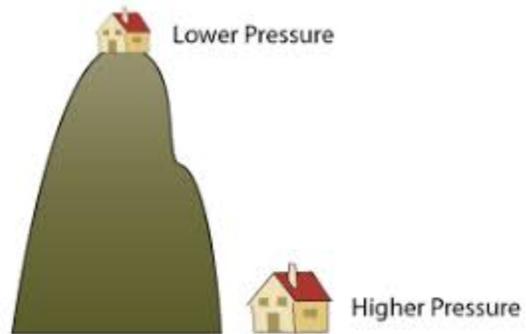
- The base of a dam has a much thicker wall than its top . This is because water pressure is higher at the base of the dam and a thicker wall is better able to withstand the higher pressure.
- Submarine Submarines dive to great depths underwater. The pressure deep below the water surface can be very high. Hence, a submarine needs a strong body to withstand this high pressure.

-ATMOSPHERIC PRESSURE-

Atmospheric pressure is the pressure exerted by the layer of air particles pushing down on Earth's surface due to gravitational force. (1 mark) Atmospheric pressure is approximately 100 000 Pa at sea level and it exerts pressure on us and on all objects on Earth. (2 mark)

When we are at a height above the sea level (e.g., on a mountain), fewer air particles push down on us. Hence, the atmospheric pressure exerted on us decreases.

Higher pressure is experienced at sea level than above sea level.



Daily lives

When a boy sucks on a straw, some air is removed from it. The air pressure inside the straw decreases and becomes lower than the surrounding atmospheric pressure. The atmospheric pressure pushes into liquid up the straw and into the boy's mouth.

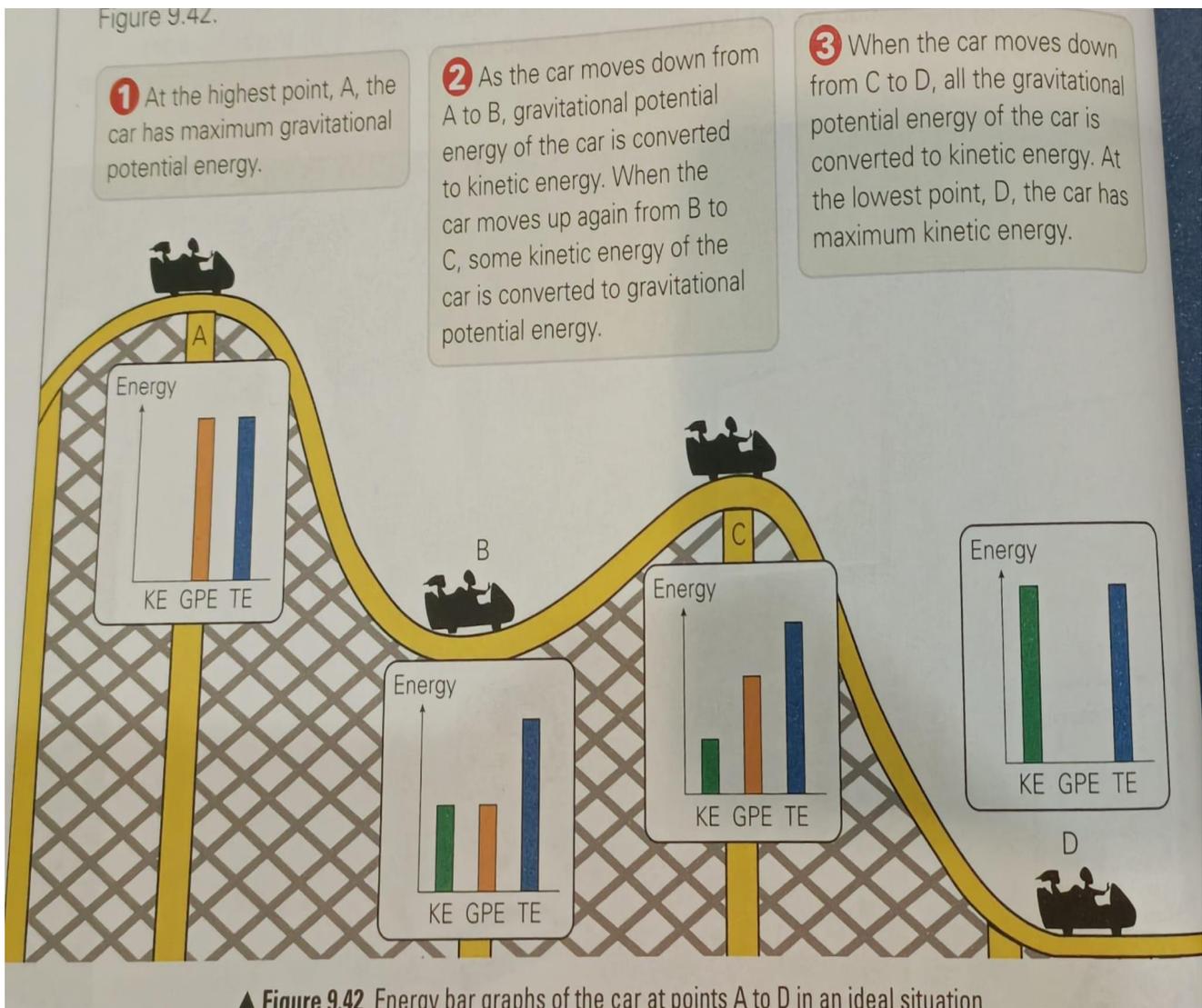
^^ Tropical cyclones can also arise due to the differences in atmospheric pressure. They are formed over warm tropical oceans in regions near the equator. The sun warms the water on the ocean surface, causing it to evaporate. The warm air rises, creating an area of lower air pressure near the surface of the ocean. Air from the surrounding area of higher air pressure flows into the area of lower air pressure. The process repeats and differences in air pressure over the ocean cause storms to develop.

- The transfer of energy and the amount of work done through the application of force have the same SI unit, which is **joule (J)**. For work to be done on an object, it must satisfy the following conditions :

- A force is applied on the object
- The object moves
- The object moves in the same direction as the force applied on it.

The SI unit of energy is joule. Energy can be converted from one form to another.

Take note -



▲ Figure 9.42 Energy bar graphs of the car at points A to D in an ideal situation

(9.5)

Fossil fuels are formed from the remains of dead plants and animals buried in earth millions of years ago. Hence it is limited and will run out one day.

Instead of using fossil fuel, other alternative sources of energy include solar energy, hydroelectric energy, geothermal energy, biofuel, nuclear energy, wind energy.(SHG BNW)

Solar energy (se)

(whats se) To capture sunlight and convert light energy into electrical energy

(energy conversion) Light energy of the sun - electrical energy of solar cell

(pros) Can generate electricity without releasing air pollutants and greenhouse gases

(cons) Requires plenty of energy to make the solar energy

Hydroelectric energy (he)

(whats he) electrical energy generated by turbines when moving water powers them.

(energy conversion) gravitational potential energy from the water stored behind the dam - kinetic energy from the moving water - kinetic energy in the turbine - electrical energy in the generator

(process in a water dam)

- 1) The reservoir water stores gravitational potential energy behind the dam
- 2) As water runs down the turbine passageway at high speed, gravitational potential energy is converted to kinetic energy.
- 3) As the moving water turns the blades of the turbine, the kinetic energy of the water is converted to kinetic energy of the turning blades.
- 4) The kinetic energy of the turning blades of the turbine is converted to electrical energy in the generator.

(pros) produce very little greenhouse gases

(cons) The reservoir water floods the area behind a dam. This kills plants and forces animals to move to other areas. People who make a living have to relocate to further inland and thus may not be able to fish anymore.

Wind energy (we)

(Whats we) used to produce electricity through the energy conversions

(energy conversions) kinetic energy from the wind - kinetic energy from the wind turbine - electrical energy in the generator

(process) When wind blows at a wind turbine, the kinetic energy of the wind is transferred to the blades of the turbine, which causes the blades to rotate. A generator connected to the turbine spins and generates electrical energy.

(pros) don't have

(cons)

- 1) Large plots of land need to be cleared to build wind farms. This results in the potential loss of wildlife as natural habitats are destroyed.
- 2) Birds may be killed if they collide into the rotating blades of the wind turbines.
- 3) The noise produced by the rotating blades can also be a source of noise pollution to nearby communities.

Geothermal energy (ge)

(whats ge) it is heat stored in earth. It can be harnessed to generate electrical energy.

(energy conversion) heat energy from the earth's core - kinetic energy from the steam - kinetic energy of the turbine - electrical energy of generator

(process)

- 1) Cooled water is pumped into the hot rocks inside the earth's core
- 2) The cooled water is heated by the geothermal energy and turns into steam
- 3) Hot water and steam are pumped up to earth's surface
- 4) Steam is used to power the turbine and generator electrical energy

(pros) don't have

(cons)

- 1) It usually requires the clearing of large areas of land. This destroys the habitats of wildlife and thus affects the diversity of species.
- 2) In addition, traces of toxic elements buried underground are also drawn out. They can cause harm to the environment if not properly handled.

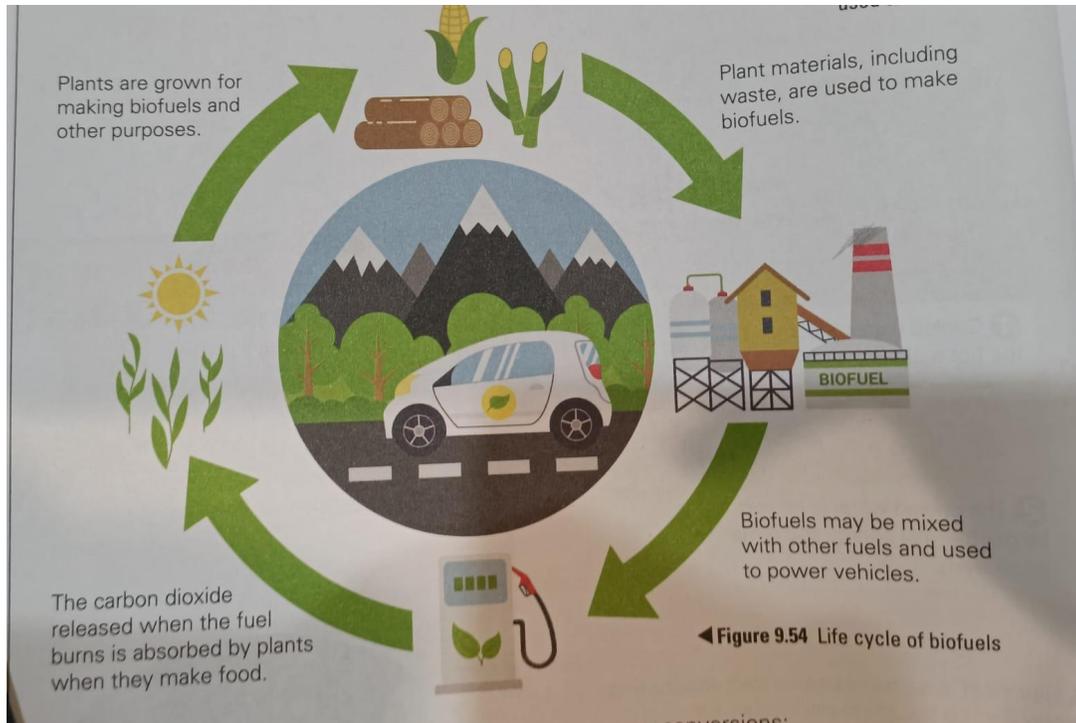
^^ A geothermal power plant uses heat from deep inside earth to generate steam, which powers a turbine to produce electricity.

Biofuel

(whats biofuel) usually made from animal waste or from plant materials that cannot be eaten by humans. They can also be produced from the recycling of food waste such as used cooking oil and plant pulp.

(energy conversion) Chemical potential energy from the biofuel - heat energy - kinetic energy of a vehicle

(process)



(pros)

- 1) The plants used to make biofuels can be grown in a short time.
- 2) It can also be made from used cooking oil and other food waste. This helps to recycle and reduce waste.
- 3) When the plants that are grown for making biofuels carry out photosynthesis, the amount of carbon dioxide they take in helps to balance the amount of carbon dioxide released when the biofuels are burnt.

(cons) The burning of biofuels releases air pollutants such as carbon dioxide into the environment.

Nuclear energy (ne)

(what's ne) energy harnessed from the nucleus of an atom. This energy can be obtained through nuclear reactions and then converted to electrical energy.

(energy conversion) nuclear energy in the atoms - heat energy - kinetic energy of the turbine - electrical energy of the generator

(pros) a source of clean energy and requires less land space to generate the same amount of energy compared to other alternative sources of energy.

(cons) potential risks to the health and safety of communities living near nuclear power plants

*All the energy excluding biofuel (SHG NW) is all used to make electricity.