

Strand 3: Force and energy

3.1: Transformation of energy

Section A

1. B
2. A
3. C
4. B
5. A
6. B
7. A
8. A
9. C
10. D

Section B

1.
 - (a) Gravitational potential energy; Kinetic energy; Light energy; Heat energy.
 - (b) Kinetic energy: This is the energy a body has because of its motion. The faster the speed of the object, the greater its kinetic energy.
Potential energy: This is the stored energy of an object due to its position.
Gravitational potential energy is a type of potential energy due to an object's position relative to the centre of the earth.
 - (c) Because it is at a height above the ground. It can release this stored energy as it falls.
2.
 - (a) A, B, C
 - (b) D
 - (c) Does not decrease in amount with use. It can be replenished over time.
3.
 - (a) It converts mechanical energy into electrical energy.
 - (b) Mechanical energy from the rotating shaft is converted into electrical energy that flows through the wires to power the headlamp.
 - (c) The headlamp goes off because the dynamo stops rotating and no longer generates electrical energy to power the headlamp.
- 4.

Appliance	Energy transformation	Everyday use
Electric kettle	Electrical energy to heat energy	Heating water
Torch	Chemical energy to electrical energy to light energy	Providing light
Electric motor	Electrical energy to kinetic energy	Used to power fans and blenders by making their parts move.

Microphone	Sound waves to electrical signals	For amplification or recording.
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5.

- (a) Solar energy.
- (b) The area receives plenty of sunshine, making solar energy readily available.
- (c) Wind energy; Hydroelectric energy.
- (d) They produce air pollution and greenhouse gases when burned. Fossil fuels are non-renewable and will eventually be depleted.

6.

- (a) Light energy → Electrical energy
- (b) Chemical energy → Electrical energy → Light energy
- (c) The batteries store the electrical energy generated by the solar panels during the day so that it can be used to power the lights at night when there is no sunlight.

7.

Activity	Hazard	Safety measure
Welding metal	Burns to the skin or eyes from sparks and intense light.	Wear a welding helmet, gloves and protective clothing.
Using loudspeakers during assembly	Hearing damage from excessive sound.	Keep the volume at a safe level and avoid standing close to the loudspeakers.
Repairing electrical wiring	Electric shock	Switch off the power supply before repairing the wiring.
Refuelling a generator	Fire caused by fuel coming into contact with a flame or spark.	Switch off the generator and keep it away from flames and sparks.

8.

Energy transformation	Where it is applied in day-to-day life
Electrical to heat	In electric cookers, heaters, iron boxes and welding machines.
Mechanical to electrical	Bicycle dynamos, generators and in production of hydroelectricity.
Electrical to light	Bulbs; torches; screens of television, computers and mobile phones; lighting in houses and streets.
Electrical to sound	Loudspeakers and small speakers.
Potential to kinetic	Flow of water from raised tanks to lower places, swings used by children and catapults.
Chemical to heat to kinetic	Car engines.

Chemical to heat to light	Gas stoves, candles.
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9. During a fire, chemical energy stored in the fuel is transformed into heat and light energy. A fire extinguisher helps to stop this energy transformation by removing heat or oxygen needed for combustion. This prevents the fire from spreading.
A moving passenger has kinetic energy. During an accident, the vehicle may stop suddenly but the passenger tends to continue moving due to the kinetic energy. The safety belt restrains the passenger, reducing their motion and preventing them from being thrown forward or out of the vehicle.

3.2: Pressure

Section A

1. B
2. B
3. C
4. C
5. C
6. A
7. B
8. A
9. C
10. B
11. B
12. B
13. B

Section B

1.
 - (a) B
 - (b) It exerts less pressure on the ground.
 - (c) Using broad shoulder straps on a school bag – spreads the force over a larger area, reducing pressure on the shoulders. Fitting a building with wide foundations – spreads the weight over a larger area, reducing pressure on the ground.
2.
 - (a) To demonstrate that pressure in liquids varies with depth.
 - (b) All the holes should be the same size so that they offer the same resistance to water flow, allowing a fair comparison of how water pressure changes with depth.
 - (c) Dams are made thicker at the bottom to withstand greater water pressure at greater depths. Water tanks are fitted with outlets near the bottom to obtain greater pressure and allow water to flow out more effectively.
- 3.

- (a) The learner with the wide padded straps was likely to feel more comfortable because the straps have a larger contact area, which spreads the force of the backpack over a larger area and therefore reduces the pressure on the shoulders.
 - (b) Wider straps increase the area of contact with the shoulders, therefore, reducing the pressure exerted on the shoulders, making the backpack more comfortable to carry.
 - (c) Wide foundations of buildings; Wide tyres on heavy vehicles.
4. When the driver presses the pedal, the piston in the master cylinder applies force to the brake fluid. This creates pressure that is transmitted equally throughout the fluid. The pressure pushes the piston in the slave cylinder, which activates the brake shoe. The brake shoe then presses the brake pads against the wheel rim, slowing or stopping its rotation.
- 5.
- (a) A sharp chisel cuts more easily than a blunt one because the same force is concentrated on a smaller area, increasing the pressure.
 - (b) A sharp knife, an axe.
 - (c) When a tool becomes blunt, its contact area increases. The same force is spread over a larger area, resulting in lower pressure, so the tool cuts or penetrates the material less easily.
- 6.
- (a) Water.
 - (b) Water is denser than kerosene. At the same depth, the pressure in a liquid depends on its density and depth. Therefore, water produces greater pressure at the hole, causing the water to flow out with greater speed and travel a longer distance.
 - (c) Depth of the liquid; Density of the liquid; Direction of pressure
 - (d) Liquid pressure increases with depth. Therefore, water exerts greater pressure on the lower part of the dam. The bottom is made thicker and stronger to withstand this greater pressure.
- 7.
- (a) Several wheels increase the total area of contact between the truck and the road. The weight of the truck is therefore spread over a larger area, reducing the pressure exerted on the road.
 - (b) Tractor with wide tyres; Bulldozer with wide tracks; Heavy construction vehicle with wide tyres; Snowmobile with wide tracks.
 - (c) The unfinished road is likely to develop deep depressions and become damaged. This is because the heavy load acting over the small contact area of the few wheels produces high pressure, causing the road surface to sink.
- 8.
- (a) when the piston is pulled back, it creates a low pressure inside the barrel allowing atmospheric pressure to push the liquid up into the syringe.
 - (b) When the piston is pushed down, it increases the pressure inside the barrel, forcing the liquid out through the nozzle.
 - (c) Pushing the piston downwards increases the pressure on the water inside the syringe.

9. When the handle is pulled upwards, the pressure inside the pump decreases and air enters through the inlet valve. When the handle is pushed downwards, the air is compressed, increasing its pressure. The high-pressure air is forced through the outlet valve and into the bicycle tyre. The valves ensure that air flows in one direction and does not return to the pump.