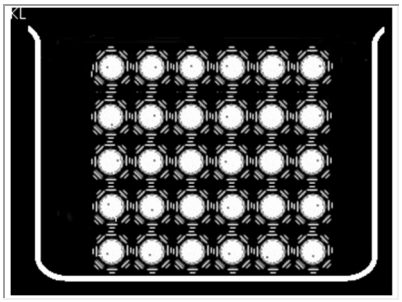
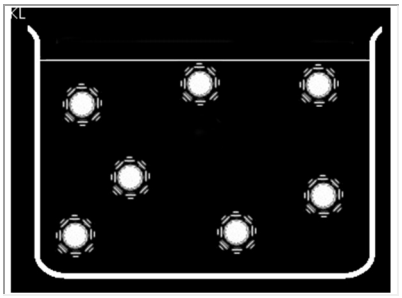
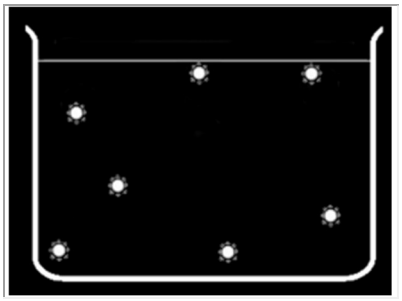
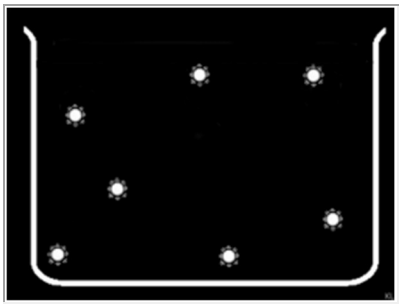
Section A

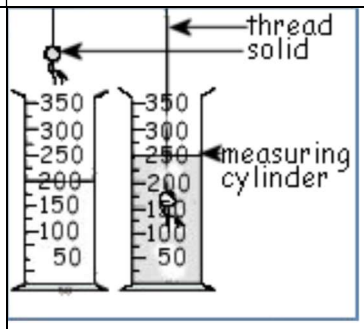
1. D
2. D
3. C
4. B
5. D
6. C
7. D
8. B
9. D
10. D
11. B
12. D
13. C
14. C
15. C
16. D
17. A
18. D
19. C
20. A
21. B
22. B
23. A
24. A
25. A

Section B

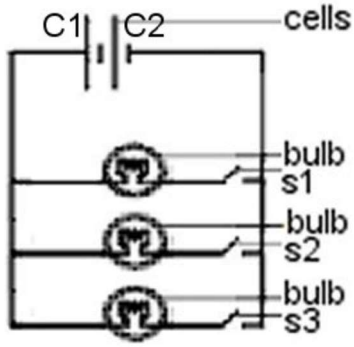
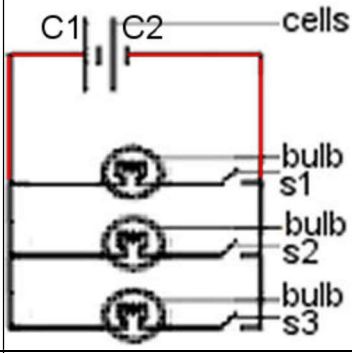
<table>
<tr><th>QU. 1</th><th>Response expected</th></tr>
<tr><td>(a)(i)</td><td>
<table>
<tr><td>  </td><td>• Particles in solids are closely packed in rows and columns in three dimensions.
• The particles maintain their relative positions</td></tr>
<tr><td>  </td><td>• Particles in liquids are loosely packed.
• The particles do not maintain their relative positions and can move about within the bulk of the liquid (bounded by the surfaces of the liquid).</td></tr>
<tr><td>  </td><td>Closed Container
• Particles in gases are very loosely packed.
• The particles do not maintain their relative positions and expand to fill the entire closed container.
• The particles can move about within the container.</td></tr>
<tr><td>  </td><td>Open or No Container
• Particles in gases are very loosely packed.
• The particles do not maintain their relative positions and expand outwards constantly escaping from the container.</td></tr>
</table>
</td></tr>
<tr><td>(a)(ii)</td><td>• Particles in solids can only rotate (1) and vibrate (1).
• Particles in liquids can rotate (1), vibrate (1) and translate within the bulk of the liquid (1).
• Particles in gases can rotate (1), vibrate (1) and translate freely to anywhere (1).</td></tr>
<tr><td>(a)(iii)</td><td>• Particles in solids have very strong inter-molecular forces.
• Particles in liquids have strong inter-molecular forces but not as strong as in solids.
• Particles in gases have little or no inter-molecular forces.</td></tr>
</table>

QU. 1	Response expected
(b)(i)	• When rain falls it reacts with carbon dioxide to form carbonic acid. • If this acidic water flows over rocks containing calcium carbonate (limestone) or magnesium carbonate (dolomite) it reacts to produce calcium hydrogen carbonate or magnesium hydrogen carbonate which dissolves in the water. • Calcium hydrogen carbonate or magnesium hydrogen carbonate in the water react with soap and inhibits lathering.
(b)(ii)	Any one of the following with all four chemicals: • calcium hydrogen carbonate + sodium stearate (soap) = calcium stearate (scum) + sodium hydrogen carbonate • calcium sulphate + sodium stearate (soap) = calcium stearate (scum) + sodium sulphate • magnesium hydrogen carbonate + sodium stearate (soap) = magnesium stearate (scum) + sodium hydrogen carbonate • magnesium sulphate + sodium stearate (soap) = magnesium stearate (scum) + sodium sulphate
(b)(iii)	Any three (3) of the following points • And initial settling in the dam or ponds where most suspended matter settles out of the water. • If there is excess suspended material (referred to as turbidity by WASA) alum may be added to precipitate these materials. • Filtration by layers of gravel to remove suspended material and sometimes carbon to remove dissolved pollutants. • Addition of chlorine to kill harmful microbes.

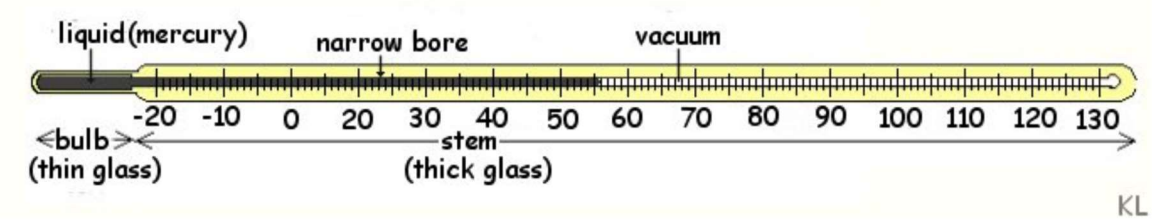
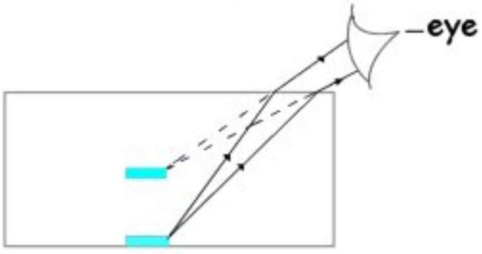
QU. 2	Response expected
(a)(i)	Any four (4) of the following points • Sugarcane is crushed and the juice collected. • The juice is filtered to remove undissolved solids. • As the juice is heated, the water evaporates and it becomes saturated. • Sugar crystals begin to form as the water in the saturated solution evaporates. • The saturated liquid remaining is called molasses.
(a)(ii)	A fine powder has more surface area than lumpy or large crystals of sugar. Any two (2) of the following points • Water acts only on the surface of the solute (sugar) to break the bonds between the molecules in the crystals. • When the bonds are broken the particles will enter the spaces between the liquid molecules. • Therefore, the more bonds of the fine powder will be broken. • Molecules of the fine powder will then enter the spaces between the liquid molecules faster.

QU. 2	Response expected
(a)(iii)	The iron chain will be pulled to the electromagnet and prevented from entering the crusher. Any one (1) of the following points • Iron is a magnetic substance • Iron will be attracted to a magnet.
(b)	• Put the mixture in water and stir vigorously. • The water will dissolve the salt and the sand will be undissolved. • Filter the water. • The salt is dissolved in the water in the filtrate. • Sand is the residue. • The salt can be recovered by evaporating the water to dryness over a flame.
(c)	 • Diagram – clear lines (1) labels (1) • Apparatus: Measuring cylinder, thread or thin string. • Add water to the measuring cylinder so that the irregular shaped solid can be completely submerged in the water. • Read the water level in measuring cylinder. • Use a thin string to gently lower the irregular shaped solid so that it is completely immersed in the water. • Take the new reading of the water level from the measuring cylinder. • The volume of the irregular shaped solid is the difference between the two readings. • Use a balance to find the mass of the irregular shaped solid. • $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$ • Calculate the density from the formula above

Section C

QU. 3	Response expected
(a)(i)	• Work is done when a force moves an object in the direction of the force. • When work is done energy is expended.
(b)(i)	 • **Cells symbol** • **Bulb symbol** • **S1 correctly positioned** • **S2 correctly positioned** • **S3 correctly positioned**
(b)(iii)	 • Switch in series with the bulbs (anywhere in the red section of the circuit)
(c)(i)	Any one (1) of the following points The circuit breaker in the house or the fuse in a car prevent • overload of circuits • the danger of fire or electrical shock by stopping the current from flowing in the circuit if it is overloaded.
(c)(ii)	It burns out if the circuit is overloaded and stop current from flowing in the circuit.
(c)(ii)	A material which allows energy (electricity, heat or sound) to flow through easily. Any metal (e.g. aluminum, iron, steel, copper, brass, bronze)
(c)(iii)	• A material which does not allows energy (electricity, heat or sound) to flow through easily. • Any non-metal e.g. (plastic, rubber, glass, fiberglass, porcelain, ceramic, dry wood)
(d)	Any six (6) of the following points: • Magnets have two poles: like poles repel and unlike poles attract • Magnets attract ferro-magnetic materials (usually iron, nickel or chromium based) • The only true test for an object being a magnet is if it repels another magnet. • Label the rods X, Y and Z. • Bring the ends of the rods together in pairs (X-Y. X-Z and Y-Z). • Switch the ends of the pairs. • The two that repel each other are magnets (with similar poles near each other) • Test by switching the ends around (for the other pair of poles to repel each other)

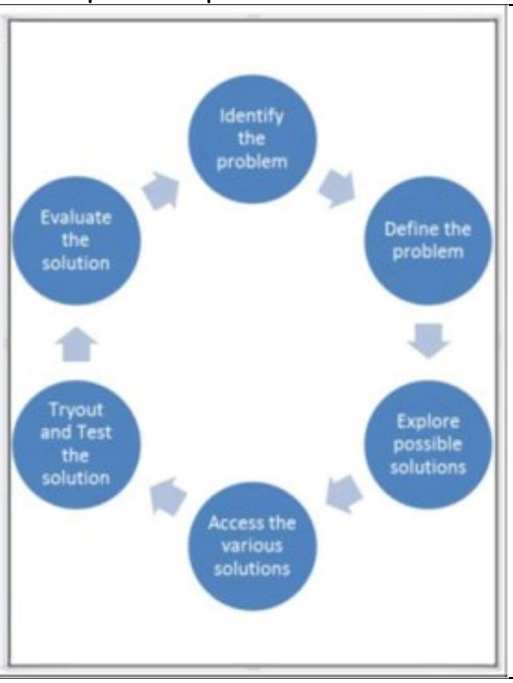
QU. 3	Response expected
(e)	The sun → plants → biofuel → turbine engine → generator → Lights / Stereo / Blender source of **EMR** → **Chemical** → **Chemical** → **Mechanical Kinetic** → **Electricity** ↑ → **EMR** energy ↑ ↑ → → → **Sound** energy ↓ ↓ ↓ → **Mechanical Kinetic** energy

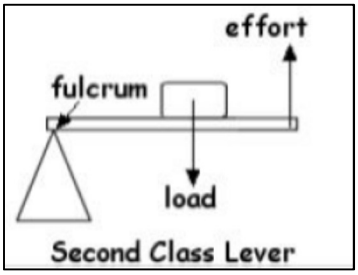
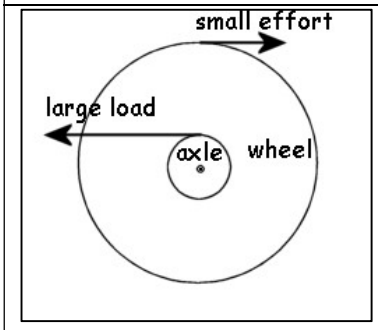
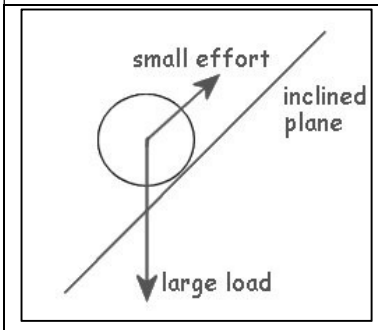
QU. 4	Response expected
(a)(i)	 • Clear lines • Proportional • Smooth lines • Three labels
(b)	Any two (2) of the following points: • Process of conduction involves heat traveling from particle to particle. • Best seen in solids. • From high temperature to low temperature. Any two (2) of the following points: • Convection is the transfer of heat through a process where the fluid (liquid or gas) itself moves. • Best seen in fluids • From lower to higher levels in the fluid Any two (2) of the following points: • Process of conduction involves heat traveling by EMR waves. • Does not need media. • From source of EMR in all directions.
(c)(i)	 • Straight lines • Two rays from the object • Two rays bent at the surface • Two rays projected backward

QU. 4	Response expected
(c)(ii)	• Refraction occurs when light moves from one medium to another and changes direction • Light travels in straight lines • The eye projects the rays from the direction in which they enter the eye
(d)	• Red • Blue • Green
(e)	Any three (3) of the following points: • Fastest to slowest speed: Land, water, air • Sound moves from particle to particle. • Particles in solids are closest and do not move around so they conduct the sound best. • Particles in liquids move around and are further apart so they are not as good conductors of sound as solids. • Particles in gas move around and are furthest apart so they are not as good conductors of sound as solids and liquids.

Section D

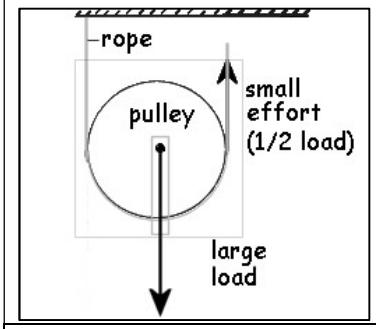
QU. 5	Response expected		
(a)(i)	Similar - Any three (3)		
	Human Activities	Use research	
	Use cyclic activity	Have processes	
	Study the world around us to create new knowledge		
	Different - Any four (4) of the following points		
		Science	Technology
	Nature	Science is knowing about the natural world	Technology is doing activities which modify, change or control the natural world
	Goals	The search for and theorizing about cause driven by curiosity	The search for and theorizing about new processes driven by needs and wants
	Value	Making virtually value-free statements	Activities always value-laden
	Evaluation Methods	Observation, hypothesis, testing hypothesis and creation of theories	Analysis and synthesis of design
	Goals achieved through	Corresponding Scientific Processes	Key Technological Processes
	Focus	Focuses on understanding natural phenomena	Focuses on understanding and improving the man-made environment
	Development Methods	Discovery (controlled by experimentation) and sometimes serendipity	Design, invention, production
	Strength	Drawing correct conclusions based on good theories and accurate data	Taking good decisions based on incomplete data and approximate models
	Skills needed to excel	Experimental and logical skills	Design, construction, testing, planning, quality assurance, problem solving, decision making, interpersonal and communication skills

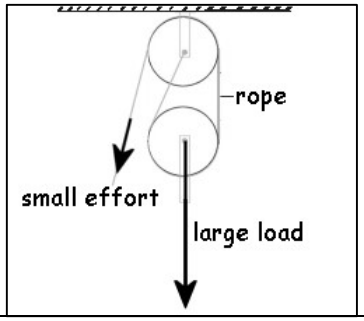
QU. 5	Response expected
(b)	I - Identify the problem What is the problem that you are trying to solve? D - Define the goal What do you want to end up with? Are there limitations on what you can do or how you can do it? E - Explore possible solutions Brainstorm ways you can solve this problem. A - Assess the alternatives What are the pros and cons about each possible solution? What will work? What won't work? Do you have everything that you need? Does the possible solution fit the parameters that are given? T - Take action Put your best possible solution to work to solve the problem and reach your goal. E - Evaluate the outcome Was the problem solved? Did you reach the goal? What worked? What didn't work? 
(c)	• Associated with modernist architecture and industrial design in the 20th century is a principle that form follows function. • The principle is that the shape of a building or object should be primarily based upon its intended function or purpose. • The floors and walls of a bathroom should be made of waterproof materials and designed so that waste water runs out easily as its function is for bathing. • A dining table should have a flat top and sturdy legs so that eating utensils will not slide off easily and there will be no wobble or shake to create spills from food and drink.

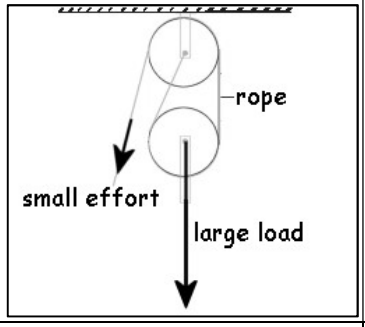
QU. 6	Response expected	
(a)	Any FOUR of the following:	
	 Any THREE of the following: Diagram • A lever can be made from a beam or stick or rod with a sharp edge on which to pivot. • This pivot is called a fulcrum. • A lever is often used to magnify the effort exerted to lift weights with less effort, but levers can sometimes be used where the load is smaller than the effort. • When you use a crowbar, for example, to open box or a nail to open a paint can or a board to move a crate you demonstrate the principle of levers. • There are three classes of levers	3
	 Any THREE of the following: • Diagram • Wheel & Axle is a circular device to which is attached a rigid axle at its centre can be used as a force or distance multiplier. • When a rope is attached to the axle, the force is applied to the wheel and as the wheel is rotated the rope winds around the axle with a force much greater than that used to rotate the wheel. • When the axle is rotated the wheel moves a much greater distance than the axle.	3
	 Any THREE of the following: • Diagram • The inclined plane is any flat, sloping surface raised at an angle. • It is a way of lifting a load that would be too heavy to lift straight up by using a ramp. • The steeper the ramp, the more effort is required. • Staircases are a special case of inclined planes. • The distance covered in a slight slope is longer than that of a steep slope, the effort required for the steep slope is much more.	3

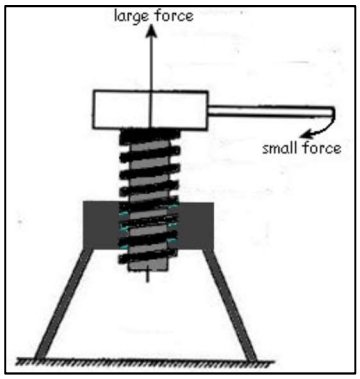
Any THREE of the following: 3

- Diagram
- A pulley is a wheel with a groove along its edge, where a rope or cable can be placed.
- It applies the principle of applying force over a longer distance
- It changes the direction of the applied force.
- Complex pulley systems of can be used to generate large forces, especially for lifting objects.



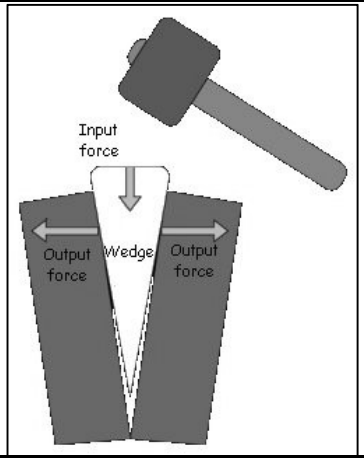






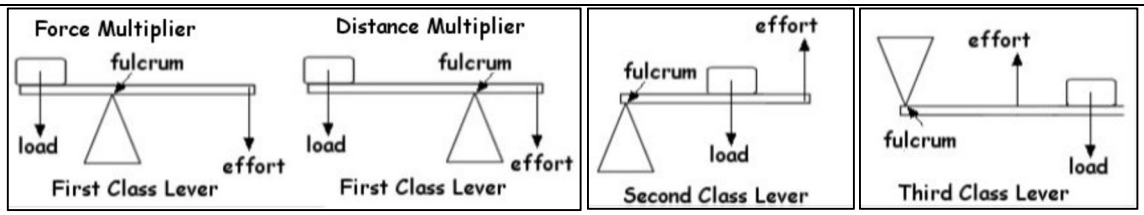
Any THREE of the following: 3

- Diagram
- A screw is a shaft that has an inclined groove along its surface.
- When the screw is rotated, the force is applied perpendicular to the groove.
- A small rotational force is translated into a large linear one.
- Screws are frequently used to fasten objects together.
- The screw can elevate water from a low-lying body to a higher one (known as Archimedes' screw).
- The force is perpendicular to the inclined surfaces, so it pushes two objects (or portions of a single object) apart or pulls them together depending on the way it is turned.



Any THREE of the following: 3

- Diagram
- A wedge is a double-inclined plane (both sides are inclined) that moves to exert a force along the lengths of the sides.
- The force is perpendicular to the inclined surfaces, so it pushes two objects (or portions of a single object) apart.
- Axes, knives, and chisels are all wedges.
- The common "door stop wedge" generates large frictional forces on the wedge surfaces to provide friction for keeping doors open.

(b)	
(c)	Any four of the following: • Deform an object • start a stationary object moving • Stop a moving object • Speed up a moving object • Slow down a moving object • Change the direction of motion of a moving object