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Unit: General Physics, Thermal Physics, Waves and Magnetism

- 1 Electromagnetic radiation has many uses. Draw a line from each use to the type of radiation it requires.

use	type of radiation
detecting an intruder at night	radio waves
communicating by satellite for a telephone	microwaves
detecting broken bones in the body	infra-red
[1]	visible light
	ultraviolet
[1]	X-rays
	gamma rays

[3]

[Total: 3]

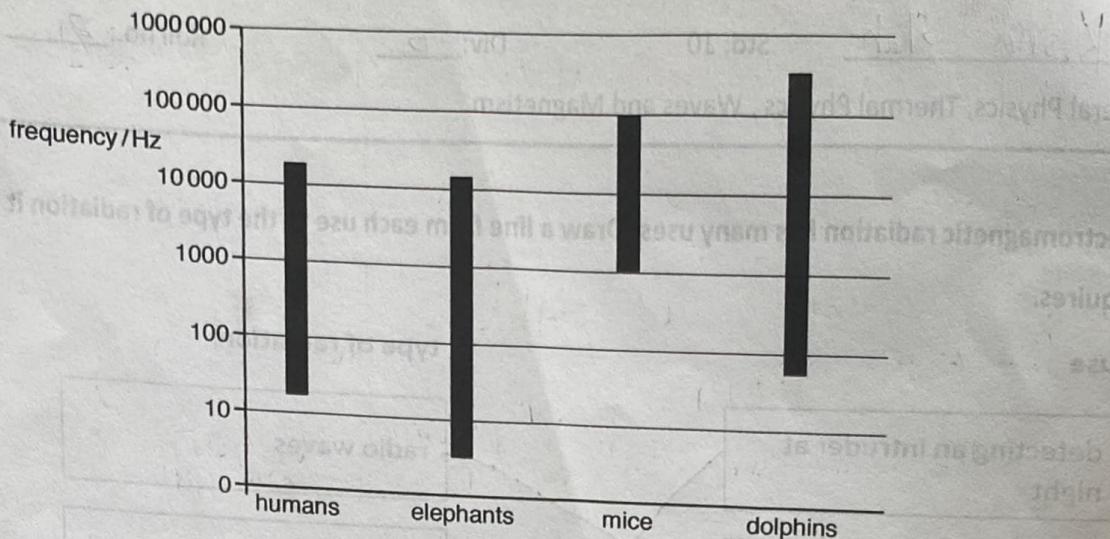
- 2 Explain what is meant by electromotive force (e.m.f.).

Electromotive force is the work done on the charge to move around a complete circuit.

[2]

[Total: 2]

- 3 Humans, elephants, mice and dolphins have different hearing ranges. The diagram shows the hearing range for each type of animal.



- (a) State the lowest frequency of sound that can be heard by mice.

1000 Hz

- (b) State the highest frequency of sound that can be heard by elephants.

11,000 Hz

- (c) Explain how the chart shows that elephants can hear some sounds that humans cannot hear.

The minimum frequency at which elephants can hear art. exceeds the minimum frequency at which humans can hear proving that elephants can hear some sounds that humans cannot.

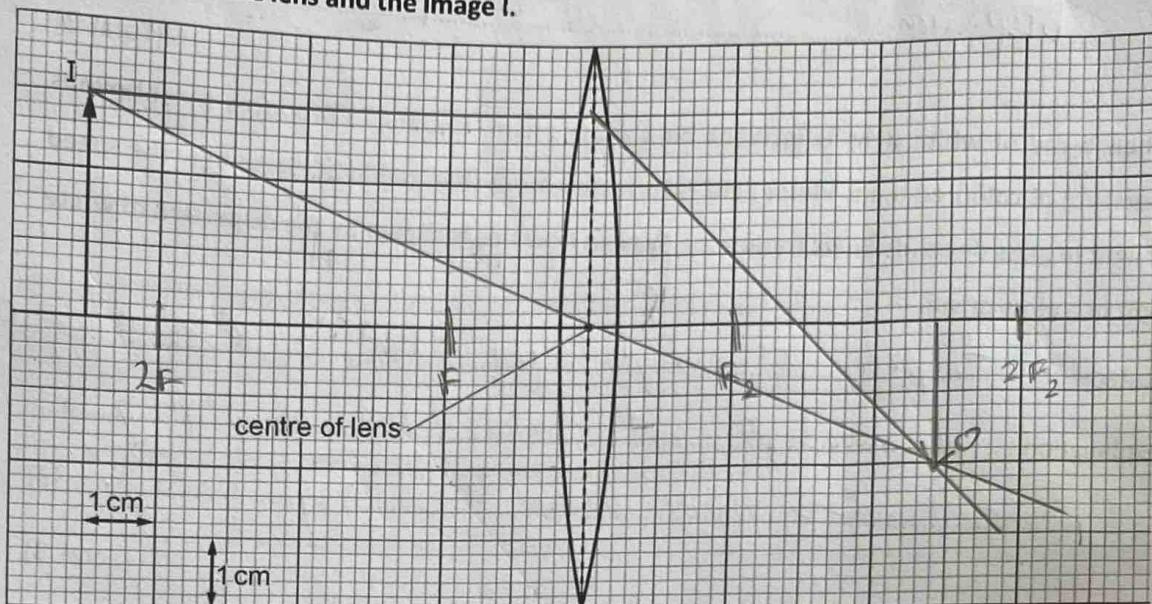
- (d) State the term given to the high frequencies that dolphins can hear but humans cannot hear.

Dolphin Echolocation

[1]

[Total: 5]

The distance between the center of a thin converging lens and each principal focus is 5.0 cm. The lens is used as a magnifying glass to produce an image I of an object O. The diagram is a full-scale diagram of the lens and the image I.

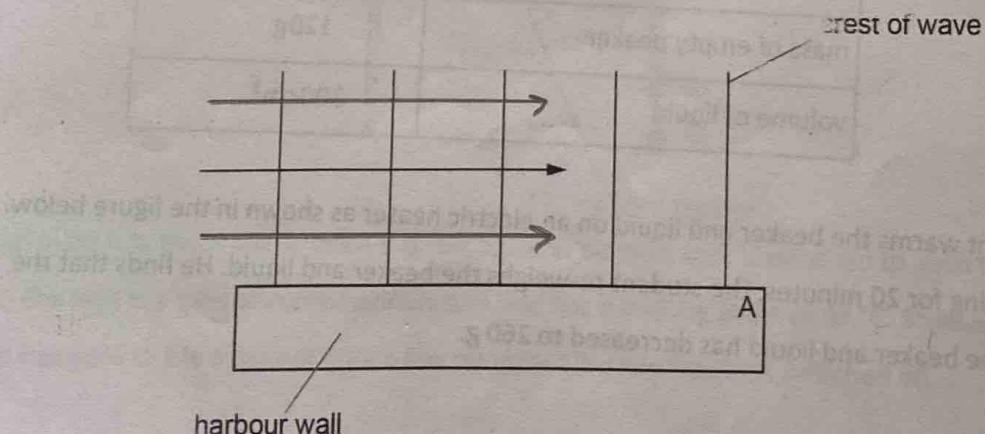


- (a) i. On the diagram, mark both principal focuses and label each of them F. [1]
- ii. By drawing on the diagram, find the position of object O and add object O to the diagram. [3]
- (b) Using the diagram, determine the distance of object O from the center of the lens.

distance = 10 cm [1]

[Total: 5]

5 The diagram shows crests of a water wave moving from left to right in a harbour.



[2]

- (a) On the diagram, draw three more crests to the right of point A.
 (b) State the name of the wave process that occurs as the wave passes point A.

Dispersion

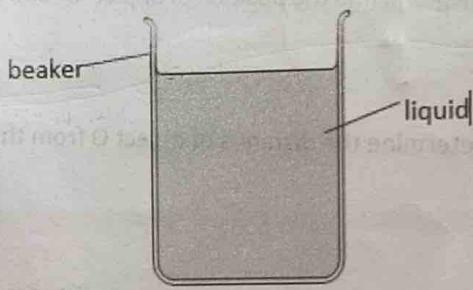
[1]
 [Total :3]

- 6 When a ray of white light is incident on a glass prism, dispersion produces a continuous spectrum of coloured light. Violet light is refracted more than red light. State how the speed of light in glass depends on its frequency. Explain how this is shown by the dispersion of white light in a glass prism.

(F) frequency \times wavelength = speed of light (v) : $\omega f \propto c$
 statement... The wavelength isn't constant and as frequency is
 explanation... a constant, it speed increases if frequency increases.... [3]

[Total: 3]

- 7 A student has a beaker of liquid as shown in the figure.



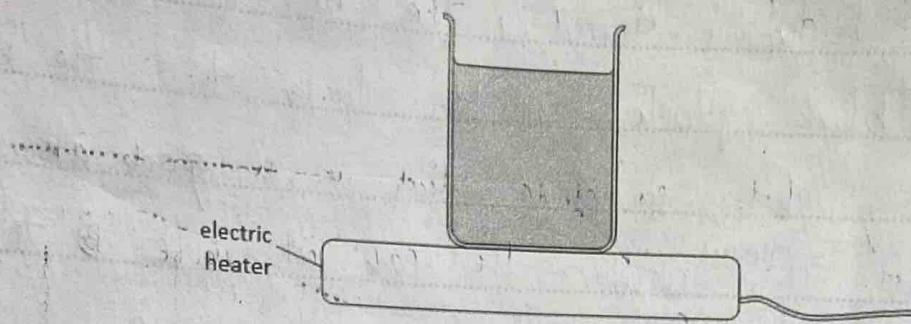
[1]

[2 marks]

The student makes some measurements. His results are shown in the table.

mass of beaker and liquid	280g
mass of empty beaker	120g
volume of liquid	200cm ³

The student warms the beaker and liquid on an electric heater as shown in the figure below. After heating for 20 minutes, the student re-weighs the beaker and liquid. He finds that the mass of the beaker and liquid has decreased to 260 g.



- (a) State the name of the process that causes this decrease in mass.

Evaporation

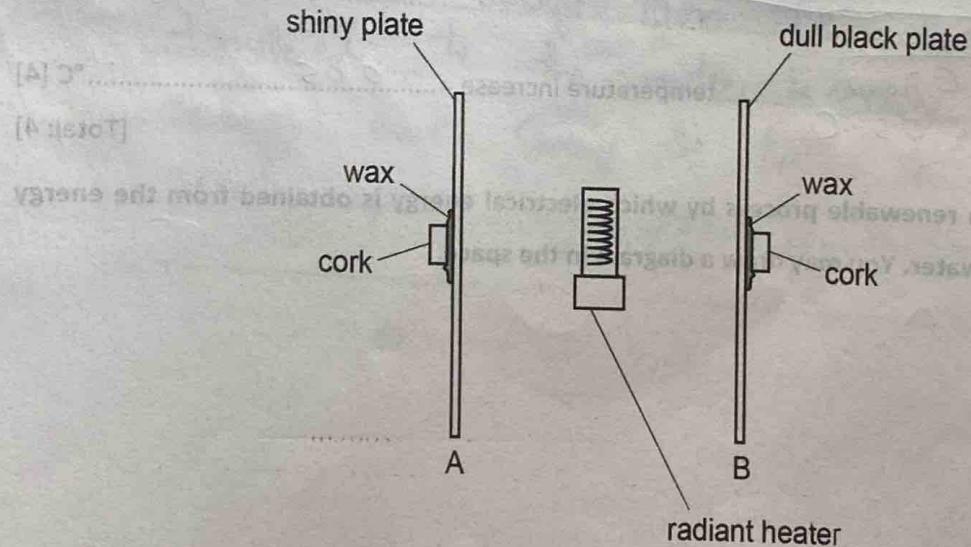
[1]

- (b) In terms of molecules, explain how this process occurs.

Due to the transfer of heat energy, water molecules vibrate more and their speed as well as collisions increase. This weakens their intermolecular force allowing the water molecules to escape from the surface. [2]

[Total : 3]

- 8 The diagram shows two metal plates A and B with a radiant heater placed midway between them.



Metal plate A is shiny. Metal plate B is dull black. A piece of cork is attached to each plate using wax. The wax is a solid at room temperature and has a melting point of 37 °C. State and explain what happens to the pieces of cork a few minutes after the heater is switched on.

As the heater is turned, the wax on the dull black plate melts faster than the wax on shiny plate, as dull black is a good absorber of heat. This causes the cork at plate B to be detached before the one at plate A.

[4]

[Total: 4]

- 9 A solar panel receives energy from the Sun at a rate of 5.0 kW. Thermal energy is transferred from the solar panel to water with an efficiency of 20%. Cold water of mass 15 kg enters the solar panel every hour. The specific heat capacity of water is 4200 J/(kg°C). Calculate the temperature increase of the water.

[5]

$$\begin{aligned}
 & \text{IE: } \frac{4200}{5000} = \frac{15 \times \Delta t}{60} \\
 & \therefore \Delta t = \frac{3600}{63000} \\
 & \quad \approx 0.05^{\circ}\text{C}
 \end{aligned}$$

$P > W$
 $W > P_x +$
 $1 \times 60 \times 60$

temperature increase = 0.05 °C [4]

[Total: 4]

- 10 (a) Describe a renewable process by which electrical energy is obtained from the energy stored in water. You may draw a diagram in the space.

Hydroelectric ^{energy} ~~power~~ is obtained using water and can be used to power generators too, it is a renewable and environment friendly process, the force of the water pushes the turbine to generate electricity. [4]

- (b) Explain why the process described in (a) can be regarded as renewable.

It is renewable as the same water can be used over and over again without any loss, and it is a reversible process too which makes it self-sustainable and renewable. [2]

- (c) Explain whether the Sun is the source of the energy stored in the water in (a).

The heat energy from the sun gets transferred to the water, increasing its kinetic energy and causing the turbines to turn at greater speeds, thus generating more electricity. [2]

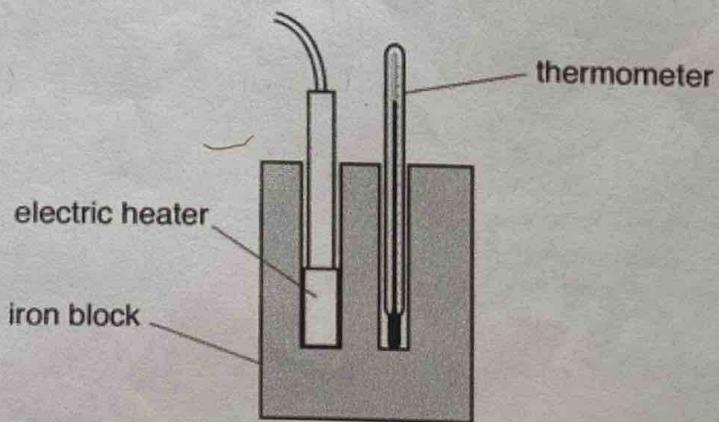
[Total: 8]

- 11 A metal container is used to cook food. The metal container has thick walls. Hot cooking oil at a temperature of 120°C is poured into the container. The outside surface of the container gets hot. Some thermal energy passes through the metal because vibrating atoms in the metal collide with neighbouring atoms and transfer energy to them. Explain how the rest of the thermal energy is conducted through the metal container to the outside surface by another process.

Through the process of convection in which thermal energy is transferred through a material by the movement of the material itself, and so the atoms of oil vibrate energy is transferred to the metal molecules, and the surface of the metal becomes hot, as the gets released through air too. [Total: 3]

- 12 Diagram A shows apparatus used by a student to measure the specific heat capacity of iron.

Diagram A



The student improves the accuracy of the experiment by placing material around the block, as shown in diagram B.