

PHYSICS 1 1993 - NECTA FORM FOUR

Solutions from: [Maktaba by TETEA](https://maktaba.tetea.org)

By Yohana Lazaro

1.(a)The Principle of the Conservation of Momentum states that: if objects collide, the total momentum before the collision is the same as the total momentum after the collision (provided that no external forces - for example, friction - act on the system).

(b)(i) momentum = mass x velocity

$$= 0.4 \times 600$$

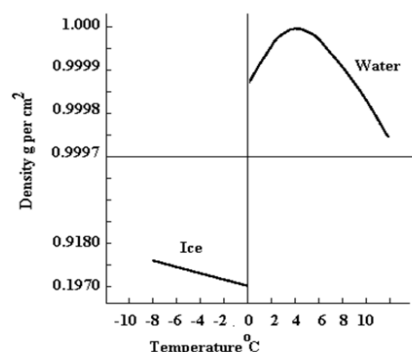
$$= 240 \text{ kg m/s}$$

(ii)let common velocity be v then from momentum conservation,

$$(0.4 \times 600) + (20 \times 0) = V (0.4 + 20)$$

Combined velocity is 11.7 m/s.

2.(a)



<https://www.toppr.com/ask/content/concept/anomalous-expansion-of-water-210020/>

(b)It enables the aquatic organisms to survive within water although the upper surface of water is frozen.

3.(a)The pressure under a liquid surface varies with depth. As depth increases, pressure increases. Thus, when a bubble rises from below the surface it encounters less pressure. This causes the volume to increase and the bubble rises in size as it rises from a depth.

(b)From, Boyle's law, $P_1V_1 = P_2V_2$

$$P_2 = (100000 \times V)/2V$$

So $P_2 = 50,000\text{Pa}$

But $P = \text{density} \times g \times \text{height}$

$$50,000 = 1000 \times 9.81 \times h.$$

depth is 5.1 m

4. (a) $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$, but $m = \frac{v}{u}$ then make u the subject, we get $u = \frac{v}{m}$ then,

$$\frac{1}{\frac{v}{m}} + \frac{1}{v} = \frac{1}{f} \text{ make } m \text{ the subject, } m = \frac{v}{f} - 1$$

(b) from magnification $= v/u = h_i / h_o$ but $4v = u$, $m = 4$ using the proved equation,

$$4 = v/15 - 1$$

Hence $v = 75 \text{ cm}$.

5. (a) Stars are the astronomical objects, that emit their own light, produced due to thermonuclear fusion, occurring at its core. Planets refers to the celestial object that has a fixed path (orbit), in which it moves around the star. They have their own light. They do not have their own light.

(b) Distance = circumference

$$= 2 \times 22/7 \times 8400 = 52800 \text{ km}$$

Then, speed = distance/time

$$= 52800/400$$

$$= 132 \text{ km/day}$$

6. When K_1 is closed, total resistance is 3Ω then,

$$(a) \text{ current} = 2/3 = 0.67\text{A}$$

(b) When both switches are closed, total resistance is $5 + 3 = 8\Omega$

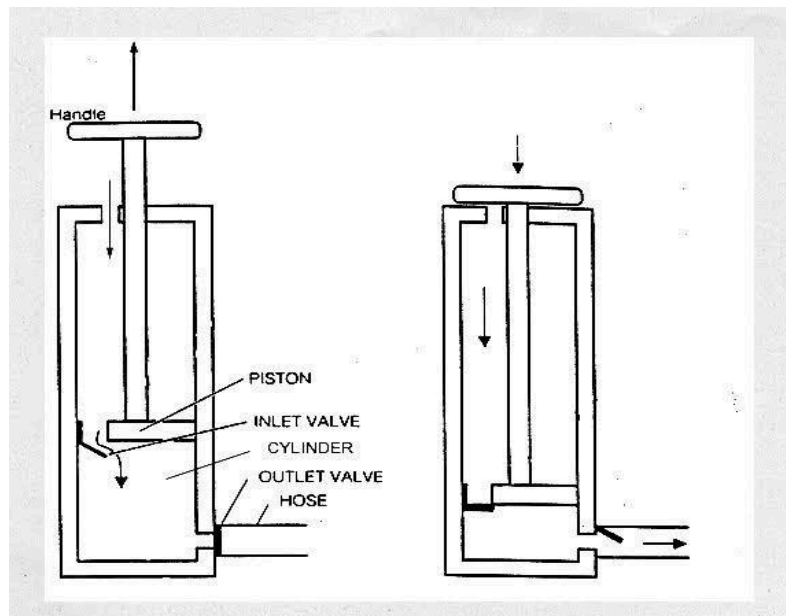
$$\text{Then, } I = 2/8 = 0.25\text{A}$$

(c) When switch K_1 is open and K_2 is closed, no current will flow.

7.(a)(i) An altimeter or an altitude meter is an instrument used to measure the altitude of an object above a fixed level.

(ii)The barograph is an instrument that makes a continuous pen and ink trace of the changing atmospheric pressure on a chart.

(b)The bicycle pump compresses air. When the cylinder is compressed, air is pushed down the tube of the pump and then into the tire via the valve, which is forced open by the pressure of the air. Some pumps have a gauge that shows the pressure of air that is forced into the tire.



https://www.researchgate.net/figure/Diagram-of-bicycle-pump-with-arrows_fig2_221249358

8.(a)They use echolocation to locate food and avoid obstacles. They have the ability to create and hear noises that humans cannot hear. The sound waves bounce off of objects and back to the bat, which can then judge the size and distance of the object.

(b)time $t = 6\text{sec}$, $v = 3 \times 10^8$

$$\text{From } v = 2d/t, 3 \times 10^8 = 2d/6$$

$$\text{Distance} = 9 \times 10^8 \text{ m}$$

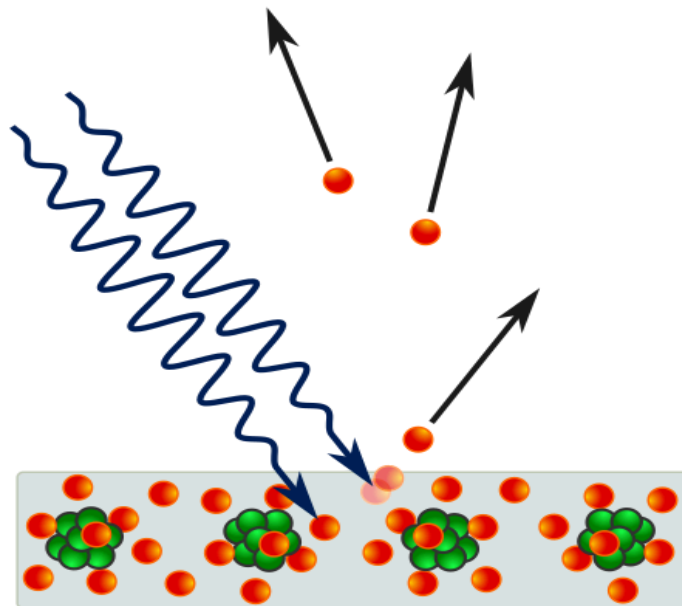
9. from $p_s = p_m + \text{density} \times g \times h$ then,

$$(1.2 \times 9.81 \times 440) = (760 - p) \times 13600$$

Then pressure is 759.6 mmHg

10.(a) Photoelectrons are Electrons emitted when electromagnetic radiation, such as light, hits a material.

(b) The photons of a light beam have a characteristic energy, called photon energy, which is proportional to the frequency of the light. In the photoemission process, when an electron within some material absorbs the energy of a photon and acquires more energy than its binding energy, it is likely to be ejected. If the photon energy is too low, the electron is unable to escape the material. Since an increase in the intensity of low-frequency light will only increase the number of low-energy photons, this change in intensity will not create any single photon with enough energy to dislodge an electron. Moreover, the energy of the emitted electrons will not depend on the intensity of the incoming light of a given frequency, but only on the energy of the individual photons.



https://en.m.wikipedia.org/wiki/Photoelectric_effect

15. (a) Ohm's law states that the potential difference in an electric circuit is directly proportional to the current at constant physical conditions.

(b)(i) For series connection,

$$\text{Total emf} = 2.5 + 2.5 = 5\text{V}$$

$$r = 2 + 2 = 4\Omega$$

$$\text{From } e = I(R + r), 5 = I(5 + 4)$$

Current is 0.56A

(ii) in parallel, total $e = 2.5V$

$$\text{Total } r = (2 \times 2) / (2 + 2) = 1\Omega$$

$$\text{Then, } 2.5 = I(5 + 1)$$

Current is 0.42A

$$(c) \text{ case 1, } e = 0.6(2 + r) \dots\dots\dots i$$

$$\text{Case 2, } e = 0.2(7 + r) \dots\dots\dots ii$$

Solving simultaneously,

$$e = 1.5V, r = 0.5\Omega$$

17.(a) It is because it possesses the additional latent heat of vaporization such that, when steam falls on the skin and condense to produce water, it gives out its latent heat of vaporization, then the boiling water at the same temperature.

(b)-evaporation is slower while boiling is faster

-evaporation occurs only on the surface of liquid while boiling occurs whole liquid.

-evaporation not produces bubbles while boiling produces lots of bubbles.

(c) Let latent heat be L

$$\text{Heat gained by calorimeter} = 50 \times 0.4 \times (100 - 4.7) = 1906J$$

$$\text{Sensible heat of water} = 100 \times 4.19 \times (100 - 4.7) = 39930.7J$$

$$\text{Mass of steam} = 154 - (100 + 50) = 4g$$

$$\text{Latent heat of steam} = 4 \times L$$

From heat lost = heat gain,

$$1906 + 39930.7 = 4L$$

$$L = 2260 \text{ kJ/kg}$$

18. (a) (i) ${}^{284}_{90}\text{He}$

(ii) ${}^{284}_{88}\text{e}$

(iii) ${}^{288}_{92}$

(b) Given count rate = 400/min, half-life = 4 days

(i) at 12 days, $12/4 = 3$, then count rate = $400 \times 3 = 1200/\text{min}$

(ii) Because this measurement is much more precise than the original estimate.