

PHYSICS 1 1992 - NECTA FORM FOUR

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

By Yohana Lazaro

1.(a) If an object's speed (velocity) is increasing at a constant rate then we say it has uniform acceleration. The rate of acceleration is constant.

$$(b) v = u + at, 500 = 0 + a \times 5$$

$$a = 100 \text{ m/s}^2.$$

From $s = ut + \frac{1}{2}at^2$, as acceleration is constant,

$$S = (0)(5) + \frac{1}{2}(100)(5)^2$$

Distance = 1250m

$$2.(a)(i) \text{ in lubricant, } RD = (37.5 - 24) \div (37.5 - 22.5)$$

Relative density of lubricant is 0.9

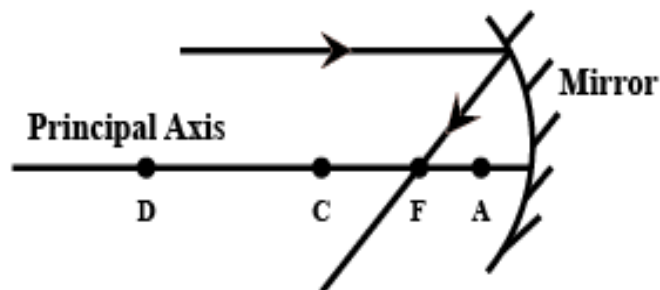
$$(ii) \text{ for glass, } RD = (37.5 \div 22.5)$$

Relative density of the glass is 1.7

(b)-Archimedes principal.

-law of flotation

3.(a)



<https://www.toppr.com/ask/en-ca/question/the-diagram-below-shows-a-ray-of-light-traveling-parallel/>

(b)from mirror formula,

$$1/U + 1/V = 1/f$$

$$f = r/2 = 10\text{cm}; 1/15 + 1/v = 1/10$$

$$v = -30\text{cm. behind the mirror.}$$

$$\text{also, from magnification formula, } m = v/u = 2$$

Nature of the image is erect.

4.From the diagram,

(a) wavelength is 20cm

(b)amplitude is 2 cm

(c) frequency = velocity ÷ wavelength

$$= 18 \div 0.2$$

$$= 90\text{Hz}$$

5.(a)While a blunt knife has more area coming in contact than a sharp knife and the pressure exerted by the blunt knife will be less as compared to that of a sharp knife. Therefore it is easier to cut with a sharp knife.

(b)given, density of water = 1kg/m^3 , height = 50m, relative density = 1.024.

From $RD = \text{density of substance} \div \text{density of water}$.

$$\text{Density of liquid} = 1\text{kg/m}^3 \times 1.024 = 1.024 \text{ kg/m}^3.$$

Then, pressure = density x height x g

$$= 1.024 \times 50 \times 9.81$$

Liquid pressure is 502.272N

6. With the closed end down and "volume" of 30 cm, the pressure inside is

$$P_1 = h_m + h_a$$

where h_m is pressure of the mercury and h_a is the pressure of the atmosphere.

(a) When the tube is held horizontally, the mercury is just a barrier, trapped air pressure equals the atmospheric ($P_2 = P_0$)

$h_2 = h_0$ the temperature is constant, according to Boyle's law:

$$P_1 V_1 = P_2 V_2$$

$$V_2 = h_1(h_m + h_0) \div h_0$$

$$= 30(25 + 75) \div 75$$

Pressure is 40 cm

(b) When the tube is again turned 90°, the atmosphere pushes the mercury upward, the mercury tries to flow downward because of gravity:

$$P_3 = P_0 - P_m = h_0 - h_m.$$

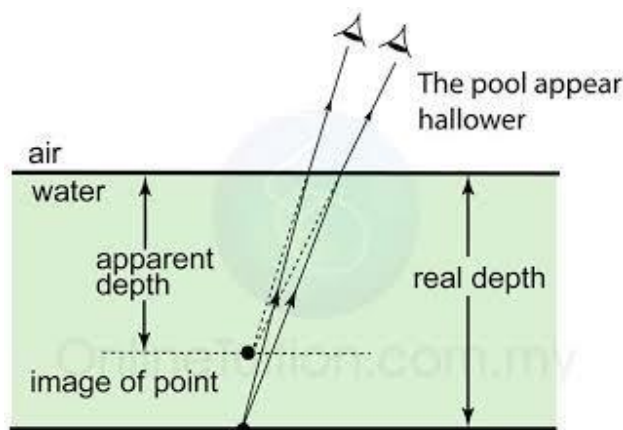
Therefore, the "volume" or height V_3 of the air in the tube is:

$$P_3 V_3 = P_1 V_1$$

$$V_3 = (P_1 V_1) \div (P_3) = h(h_0 + h_m) \div (h_0 - h_m) = 30(75 + 25) \div (75 - 25) = 60.$$

Pressure will be 60 cm.

7.(a).The light travels from the bottom of the pool, through the water, then through the air into your eye. The light travels in such a way that the pool often appears to be shallower than it really is.This is due to refraction of light Ray's when passes from water to air.



<http://content.myhometuition.com/2020/04/17/5-2-4-phenomena-due-to-refraction/>

(b) From, refractive index = real depth ÷ apparent depth

$$\text{real depth} = 9 \times \frac{4}{3}$$

$$= 12 \text{ m.}$$

8.(a)Using Ohm 's Law to Calculate Voltage Changes in Resistors in Series

According to Ohm's law, the voltage drop, V , across a resistor when a current flows through it is calculated by using the equation $V=IR$, where I is current in amps (A) and R is the resistance in ohms (Ω).

So the voltage drop across R_1 is $V_1=IR_1$, across R_2 is $V_2=IR_2$, and across R_3 is $V_3=IR_3$. The sum of the voltages would equal: $V=V_1+V_2+V_3$, based on the conservation of energy and charge. If we substitute the values for individual voltages, we get:

$$V = IR_1 + IR_2 + IR_3.$$

$$= I(R_1 + R_2 + R_3) \text{ divide by } I \text{ Bothsides}$$

$$\text{So, } R_e = R_1 + R_2 + R_3.$$

$$(b)\text{For parallel connection, } R = (2 \times 2) \div (2 + 2) = 1\Omega$$

Also in series, $= 1 + 3 = 4\Omega$

From, $\text{emf} = I(R + r)$

$$2 = I(4 + 1)$$

Current $I = 0.4\text{A}$

9. Primary colors are the three pigment colors that cannot be mixed or formed by any combination of other colors whereas secondary colors are formed by mixing the primary colors. Secondary colors are those which are formed by mixing two primary colors in equal proportions.

10.(a) mass is the amount of "matter" in an object.

whereas weight is the force exerted on an object by gravity.

(b) An object with a large amount of mass will exert more gravitational force than an object with a small amount of mass. Since Earth has more mass than the moon-about six times as much-it exerts more gravitational force. by the moon's gravity.

11.(a) Frequency = no. Of oscillations \div 5

$$= 2.5 \text{ oscillations} \div 8 \text{ milliseconds}$$

Hence, frequency is 312.5 Hz.

(b)-Sound B has the small pitch because has large pressure, so has low loud, compared to sound A which has small pressure hence large pitch and also louder.

12.(a)(i) Heat describes the transfer of thermal energy between molecules within a system and is measured in Joules. Temperature describes the average kinetic energy of molecules within a material or system.

(ii) Difference in temperature between the two points.

(b) The radiation emitted by a body depends on its temperature and the nature of its surface. More specifically, according to Kirchhoff's law, the ratio between emissivity and absorptivity is identical for all bodies at a given temperature and corresponds to emissivity of a black body ESB at this temperature. In this experiment, we will heat a Leslie cube by filling it with water to a temperature of 100°C and ascertain the radiated intensity in a relative measurement using a Moll thermopile.

13.(a), the magnitude of the induced emf depends on the change in magnetic flux and also on the time in which the magnetic flux changes.

(b) The pointer in the galvanometer will deflect in the opposite direction of the magnet.

(c)(i) The lamp will light.

(ii) This is due to the induced emf in the coils.

14.(a)(i) It means that every 1600 years half of the radium will decay.

It means that after every second one half of a given substance will decay.

(ii) Its expression is

$$t_{1/2} = \lambda / 0.693$$

where λ is the decay constant. Thus, it is a constant value.

From the graph,

$$N = (N_0/8)(e^{\lambda \times 3400}), \lambda = 0.0006116$$

Then, half life = $0.0006116 \div 0.693$

$$= 8.82 \text{ years.}$$

(b)(i) $213 = 209 + a, a = 4.$

$$84 = 82 + b, b = 2.$$

(ii) $209 = c + 0, c = 209.$

$$82 = d - 1, d = 83.$$

(iii) A is helium.

15.(a)(i) An emf is induced in a coil or conductor whenever there is change in the flux linkages.

(ii) Faraday's law states that the EMF induced by a change in magnetic flux depends on the change in flux Δ , time Δt , and number of turns of coils.

(iii) -Change the magnetic field strength (increase, decrease) over the surface area.

-Change the area of the loop (increase by expanding the loop, decrease by shrinking the loop).

(iv) Faraday's first law of electromagnetic induction states that "Whenever a conductor is placed in a varying magnetic field, an electromotive force is induced.

(b) From, $N = e, N_p/N_s = e_p/e_s$

$$e_s = N_s \times e_p / N_p = (40 \times 240)/800$$

(i) secondary emf is 12 V

(ii) New current, recall that, $I_s = N_s \times I_p / N_p$

$$= (40 \times 0.2) / 800$$

Current in secondary coil is 0.01 A

16.(a) Heat capacity is the amount of heat required to raise the temperature of an object by 1K. The specific heat of a substance is the amount of energy required to raise the temperature of 1 gram of the substance by 1K.

(b) Let final temperature be T

$$\text{-heat lost by water} = 500 \times 4200 \times (100 - T)$$

$$\text{-heat gained by copper} = 1000 \times 400 \times (T - 15)$$

From heat lost = heat gained

$$500 \times 4200 \times (100 - T) = 1000 \times 400 \times (T - 15)$$

$$T = \text{final temperature} = 86.4^\circ\text{C}$$

$$\text{(b)-heat capacity of water} = 0.42 \times 86.4 = 36.288 \text{ J/g.}$$

$$\text{-heat capacity of copper} = 0.4 \times 86.4 = 34.56 \text{ J/g}$$

17.(a)-work is the product of force and distance moved by it.

-energy is the ability of doing work.

-Power is the rate of doing a work.

$$\text{(b)} v = u + at, 10 = 0 + 30a$$

$$a = 0.33 \text{ m/s}^2$$

$$\text{From, } F = ma, F = (3000 \times 0.33)$$

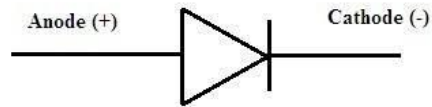
$$\text{(i) Force} = 990 \text{ N.}$$

$$\text{(ii) power} = \text{Force} \times \text{velocity}$$

$$= 990 \times 10$$

$$= 9900 \text{ Watts.}$$

18.(a) A diode is a two-terminal electronic component that conducts current primarily in one direction.



<https://www.watelectronics.com/types-of-diodes-applications/>

(b)(i) Rectification is the process of converting AC to DC.

(ii) Demodulation is The process of separating the original information or SIGNAL from the MODULATED CARRIER

(c).Uses of a diode.

- Rectifying a voltage: turning AC into DC voltages.
- Drawing signals from a supply.
- Controlling the size of a signal.
- Mixing (multiplexing) signals.
- As freewheeling of the inductive energy.

