PRACTICE PAPER 01 FOR G.C.E A/L STUDENTS – 2024

CONDUCTED BY TAMIL STUDENTS OF FACULTY OF ENGINEERING
UNIVERSITY OF MORATUWA

01 – PHYSICS

ANSWERS (MARKING SCHEME)

01 - Physics

Q.No.	Ans. No.	Q.No.	Ans. No.	Q.No.	Ans. No.	Q.No.	Ans. No.	Q.No.	Ans. No.
01.	**3**	06.	**3**	11.	**2**	16.	**3**	21.	**2**
02.	**5**	07.	**5**	12.	**3**	17.	**1**	22.	**5**
03.	**1**	08.	**4**	13.	**3**	18.	**4**	23.	**4**
04.	**5**	09.	**5**	14.	**1**	19.	**4**	24.	**4**
05.	**4**	10.	**3**	15.	**1**	20.	**3**	25.	**3**

MCQ Explanations

1. $P = F \times V$

   $10000 = F \times 10$
   $F = 1000$ N
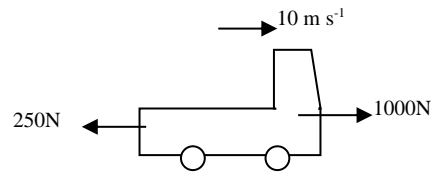   P- constant
   When $v \to vx$, $F \to \frac{F}{x}$
   To find maximum velocity
   Air resistance force = exerting force
   $$250x = \frac{1000}{x}$$
   $x = 2$
   maximum velocity= 20 m s^{-1}

   Answer- 3
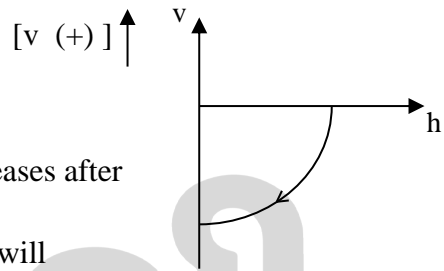
2. When releasing the ball, height=h , velocity= 0

   Velocity increases when height decreases
   $\frac{1}{2}mv^2 = mgh$ $v^2 \infty\, h$
   Therefore,
   As it rebounces to $\frac{2h}{3} (< h)$ height only, its velocity decreases after
   it collides with ground.
   Then velocity decreases when height increases. Velocity will
   become 0 when h= $\frac{2h}{3}$

   Answer- 5

3. total area=$28x^2$

   total mass=7m
   $20x^2$=5m
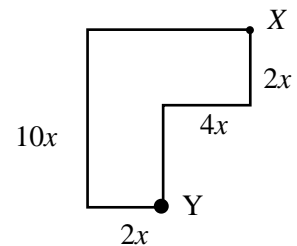 $8x^2$=2m
   The normal reaction given by the floor can be moved only up to
   Y to maintain the equilibrium.
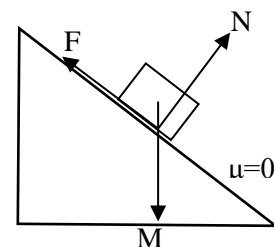   Take moment about Y
   $$5m \times x = 2m \times 2x + M \times 4x$$
   $$M = {}^m/_4$$

   Answer- 1

4. Resultants of F&N would be vertically upwards, if block is at rest
   or travels with uniform velocity.

   As block moves with acceleration along the inclined plane, enough
   force F to maintain equilibrium isn't obtained. Therefore, line of
   reaction will be in β angle with vertical.

   Answer- 5

5. (A) When monkey moves from B to A, C.M of monkey (approximately) will move from P to Q.

Reaction given by wall to A will goes through intersection point of resultant weight and string.

Reaction will decrease and increase

(B) When monkey is at A&B,Therefore, tension in the string is high when monkey is at B. So, high possibility of string to break.
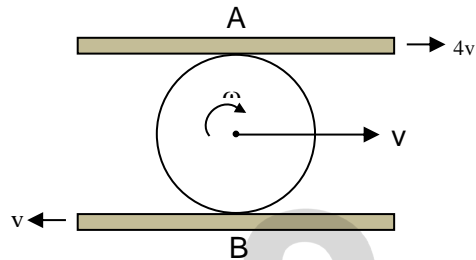
(C) True statement.
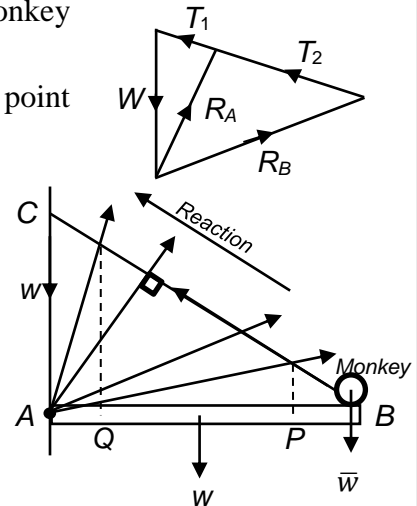
Answer- 4

6. Let the linear velocity= u & angular velocity = ω

At A, $4v=u+r\omega$
At B, $v=r\omega-u$
$5v=2r\omega$
$\omega=\frac{5v}{2r}$

Answer- 3

7. Maximum force can be given to 2kg block= $0.5 \times 20 = 10N$

Maximum acceleration of 2kg $= \frac{10N}{2kg} = 5ms^{-2}$

To move 2kg&5kg blocks to move without slipping, 5kg block also should move with 5ms^{-2} acceleration.

For system, F = ma
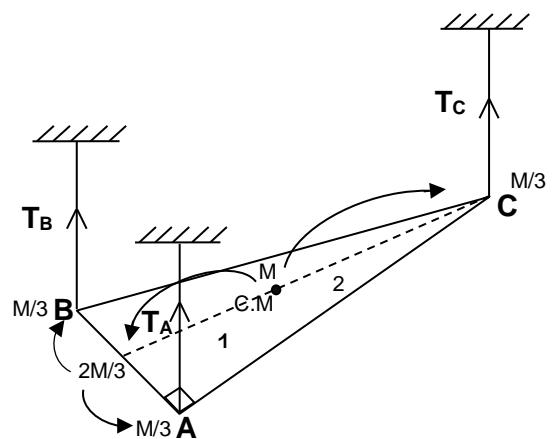$F = 7kg \times 5ms^{-2} = 35N$

Answer- 5

8. As point mass is placed in centre of mass, tension acts on all 3 strings are same.

(mass on CM can be divided equally tovertices of triangle)

Answer- 4

9. Statement A:

the angular velocities of four wheels are not same because the three small wheels will rotate in opposite direction of the big wheel. $\therefore$ Angular velocity is not same.

Statement B:

the linear speeds at contact points will be same (because the radius of three small wheels are same) $\therefore$ the contact points will leave from the contact points with same linear speeds. $\therefore$ Linear speeds are same.

Statement C:

the rotational frequency will not be same because the big wheel won't perform one full rotation when small wheels complete their one full rotation. $\therefore$ Rotational frequency is not same.

Answer-5

10. (1) Velocity increases as vehicle accelerates in t_0-t_1 and t_3-t_5 time intervals.
  (2) Velocity doesn't increase uniformly as vehicle accelerates with various acceleration in t_2-t_3 time interval.
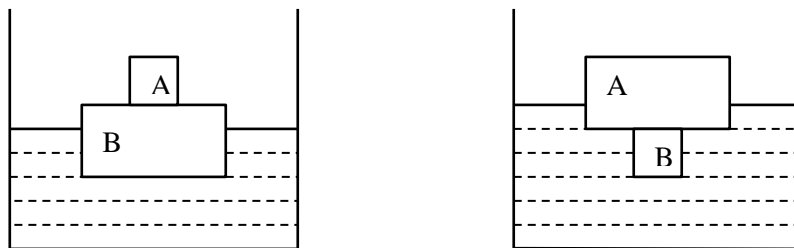 (3) Velocity increases as vehicle involves to constant acceleration in t_1-t_2 time interval.
  (4) Velocity is maximum at $t=t_6$ as vehicle accelerates from t_0-t_6
  (5) Velocity of vehicle increases non-uniformly in t_3-t_5 time interval as acceleration changes.

Answer-3

11.

Let the volume of water displaced by cuboid B be V_B

Let the volume of cuboid A be V
In both above instances the up thrust exerted by the water is same
(Mass is same in both instances)
So

$$V_B \rho_w\, g + V_1 \rho_w\, g = (V_B - V_2) \rho_w\, g + V \rho_w\, g$$
$$V_1 = -V_2 + V$$
$$V = V_1 + V_2$$

Answer - 2

12. Force that have to be applied to mass *m* in unit time in order to give *v* velocity ; F = *mv*
    According to Newton's third law, the force exerted on firecracker when it is fired is *mv*.
    $\therefore$ Torque about axis $\tau = mv \times r$
    Apply $\tau = I\alpha$
    $mv \times r = \frac{1}{2} Mr^2 \times \alpha$
    $\alpha = \frac{2mv}{Mr}$

    Answer - 3

13. According to Archimedis principle,

    upthrust = weight of fluid displaced

    $h\rho g \times 2rl - F = \frac{\pi r^2}{2} \times l\rho g$

    $\frac{15}{100} \times 1000 \times 10 \times 2 \times \frac{10}{100} \times \frac{30}{100} - F = \frac{3}{2} \times \left(\frac{10}{100}\right)^2 \times \frac{30}{100} \times 1000 \times 10$

    F = 45N ↓   Answer-3

14. (A) As fluid is at rest,

    Pressure at P = Pressure at Q
    $\pi + h_1\rho g = \pi + h_2\rho g$
    $\therefore \quad h_1 = h_2$
    $\therefore$ Liquid will found upto level Z in tube Q
    (B) If R is opened,
    Z level > Liquid level > X level
    as liquid rise only due to static pressure when liquid has a velocity at Q
    (C) Eventhough Q is   shape, liquid rise only due to static pressure.
    Therefore, liquid level in tube P > liquid level in tube Q   Answer- 1

15. (A)True for any value of e

    (B)Statement is false. There is a possibility for A to become rest after the collision.

    (C)The magnitude of impulse act on A and B during collision will always be same.

    (momentum should be conserved)

    Answer-1

16. Volume of metal block = V

    Let volume of air bubble= v
    According to Arichimedis principle,

    $$\text{Upthrust} = \text{Weight}$$
    $$\frac{V}{2}\rho_{Water}\,g + \frac{V}{2}\rho_{Oil}\,g = (V\text{-}v)\,\rho_{Metal}\,g$$
    $$\frac{V}{2} \times 1000 \times g + \frac{V}{2} \times 800 \times g = (V\text{-}v) \times 2400 \times g$$
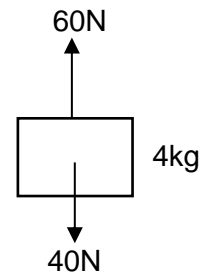 $$\frac{v}{V} = \frac{5}{8}$$

    Answer- 3

17. Tension in the string should be 60N in order to have 6kg at rest. As pulley is light & frictionless tension in both ends of string are same.

    60N

    4kg

    40N

    4kg mass $\uparrow a = \frac{F}{m} = \frac{20}{4} = 5ms^{-2}$
    Therefore, pulley should accelerates with 2.5ms^{-2} upwardly.
    $\therefore$ Pulley should be moved upwardly.
    Reading = 60N + 60N = 120N (pulley is light)

    Answer- 1

18. Let the velocity of vehicle be v when ball is thrown.

    Apply v=u+at for ball upwards
        -5=5+ (-10)t
        t=1 sec
    It will take 1s to reach the vehicle again. Ball will have v horizontal velocity until it reaches the vehicle again.
    Horizontal distance travelled by ball in 1sec= v×1
    Horizontal distance should be travelled by vehicle in that 1s= v+20
    Apply s=ut+$\frac{1}{2}$ at^2 for vehicle

    v+20= v×1 + $\frac{1}{2}$ a1^2
    a = 40ms^{-2}

    Answer- 4

19. As rod is in horizontal equilibrium,

    Moment of mass of right side = Moment of mass of left side
        about point of contact of rod with spring balance
    But, perpendicular distance from point of contact of spring balance with rod to masses on both sides are same.
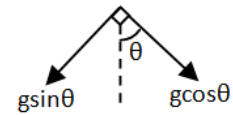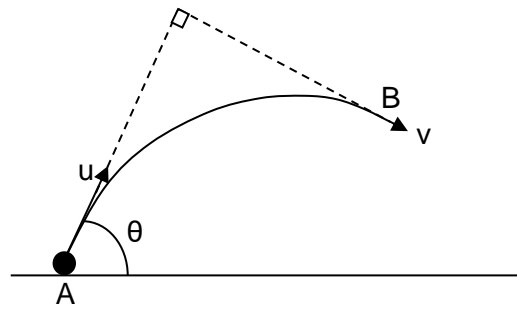 $\therefore$mass on right side = mass on left side
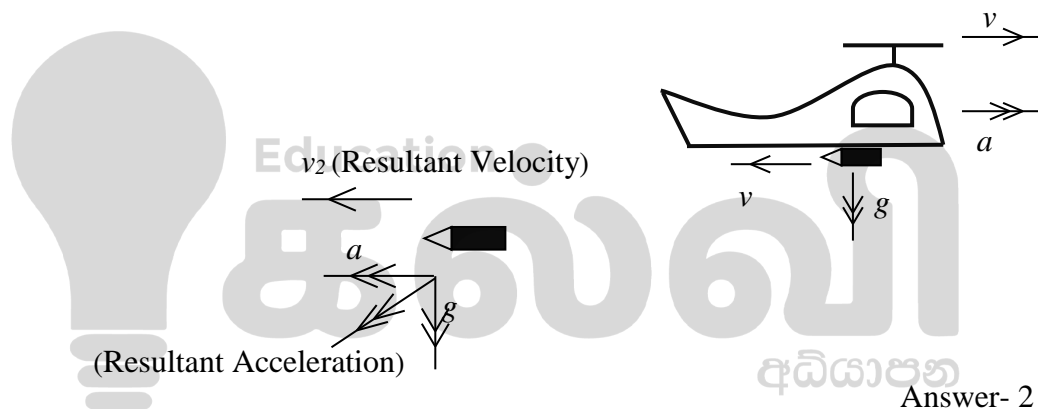 $\therefore$ Reading of spring balance= 2(m$_2$+M$_2$) + M$_1$

    Answer- 4

kalvi.lk

20. A→ B

$\nearrow \quad v = u + at$

$0 = u - g\sin\theta \times t$

$t = \dfrac{u}{g\sin\theta}$

$\searrow \quad v = u + at$

$v = 0 + g\cos\theta \times t$

$v = g\cos\theta \times \dfrac{u}{g\sin\theta}$

$=\dfrac{u}{\tan\theta}$

Kinetic energy of particle at B $= \dfrac{1}{2}m\left(\dfrac{u}{\tan\theta}\right)^2$

$=\dfrac{mu^2}{2(\tan\theta)^2}$

Answer-3

21. If bullet is fired, $V_2>0$ Motion of bullet relative to helicopter,

v_2 (Resultant Velocity)

a

g

(Resultant Acceleration)

Answer- 2

22. According to Bernouli's principle, a resultant pressure acts in ball.

$$P_1 - P_2 = \dfrac{1}{2} \times 1.2[(3ms^{-1} + 0.05 \times 20 rads^{-1})^2 - (3ms^{-1} - 0.05 \times 20 rads^{-1})^2]$$

$=0.6\times 12 Pa$

Force acts on ball $=0.6\times 12 Pa \times \pi r^2$

$=0.6\times 12 Pa \times 3 \times 0.05^2$

To ball $F = ma$

$a = \dfrac{0.6\times 12 \times 3 \times 25 \times 10^{-4}}{0.3}$

$=18\times 10^{-2} ms^{-2}$

Time taken by ball to reach wall $= \dfrac{30m}{3ms^{-1}} = 10\ sec$
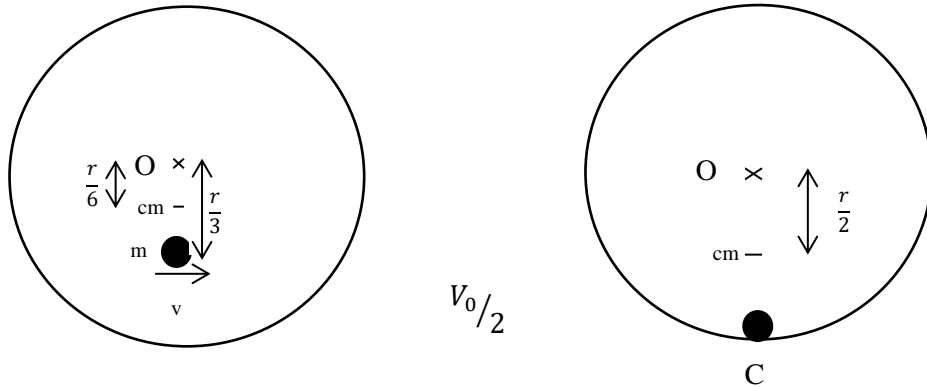
Apply $s = ut + \dfrac{1}{2}at^2$ in the accelerating direction

$s = 0 + \dfrac{1}{2} \times 18 \times 10^{-2} ms^{-2} \times 100 s^2 = 9m$

Answer- 5

23.

$$\frac{V_0}{2}$$
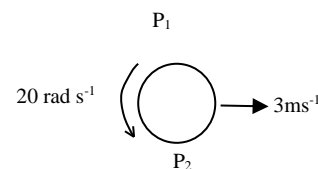
The total momentum of disk and ring = momentum of disk

$$= m \times v$$
$$= mv$$

The mass of the total system   = mass of disc + mass of ring
$$= m+m$$
$$= 2m$$
$$= mv/2m$$
$$= v/2$$

The displacement attained by the system = velocity × time
$$= v/2 \times t$$

Let the center of mass of the system= C.M

Displacement of the ring = OO'

$$= \sqrt{\left(\frac{vt}{2}\right)^2 + \left(\frac{r}{2} - \frac{r}{6}\right)^2} \qquad = \sqrt{\frac{(vt)^2}{4} + \frac{r^2}{9}}$$

Answer-4

24. The total mechanical energy is same at initial instance and at the time where X leaves A

V-velocities of X , Y when X leaves
ω   =angular velocity of the plank

Initial energy=final energy

$$2mgl\sin 30^0 = mgl\sin 30^0 + \frac{1}{2}I\omega^2 + \frac{1}{2}mv^2 + \frac{1}{2}(2m)v^2$$

$$mgl = \frac{mgl}{2} + \frac{1}{2}\frac{ml^2}{12}\left(\frac{v}{l/2}\right)^2 + \frac{1}{2}mv^2 + mv^2$$

$$gl = \frac{gl}{2} + \frac{1}{6}v^2 + \frac{1}{2}v^2 + v^2$$

$$\frac{10v^2}{6} = \frac{gl}{2}$$

$$v^2 = \frac{3gl}{10}$$

$$v = \sqrt{\frac{3gl}{10}}$$

Answer-4

25. Let the time taken to collide with wall be ; Δt

$$F = \frac{m\Delta v}{\Delta t}$$

R= $\frac{2kg(4-(-4))}{\Delta t}$

R= $\frac{16}{\Delta t}$

(after the collision) $\tau = Fr = \frac{I\Delta\omega}{\Delta t}$

F× $1m = \frac{\frac{1}{2}\times 2kg\times 1m^2(8-4rads^{-1})}{\Delta t}$

F= $\frac{4}{\Delta t}$

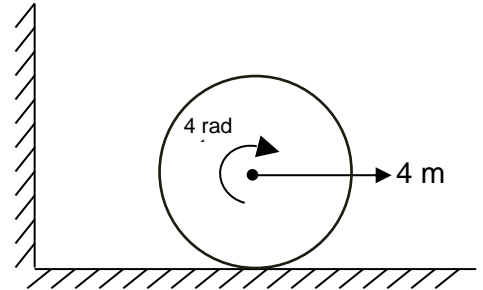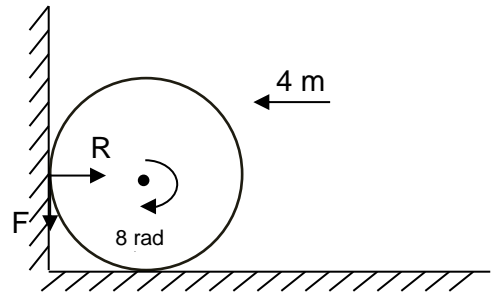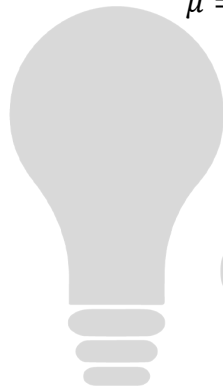Angular velocity should be possessed to roll without slipping

; $v = r\omega$

$\omega = \frac{4ms^{-1}}{1m}$ =4rads^{-1}

Apply $F = \mu R$

$\mu = \frac{F}{R} = \frac{\frac{4}{\Delta t}}{\frac{16}{\Delta t}} = \frac{1}{4}$

Answer-3

Part A - Structured Essay

1. (a) (i)
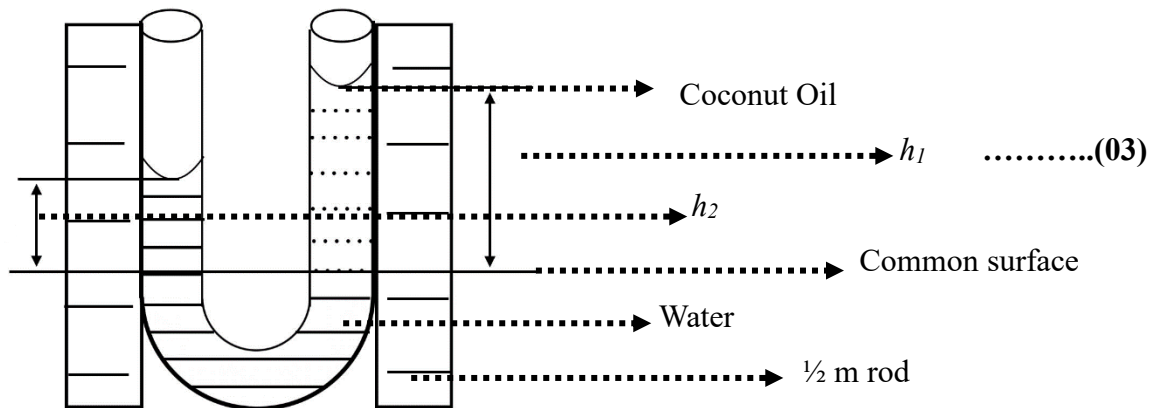
 (ii) Setsquare. …………………………………………………………..…………(01)
 (iii) Since fixed on a board both arms of U-tube will have same slant
  or both will be parallel. …………………………………………….....….. (01)
  Hence it can be neglected in calculations.
 (iv) First rinse the U-tube with sodium hydroxide (NaOH). ……………..……………(01)
  Then with diluted hydrochloric acid (HCl).
  Then with distilled water.
  Then dry it.

(b) (i) $P_o + h_1 d_1 g = P_o + h_2 d_2 g$ …………………………………….……… (01)
  $h_1 d_1 = h_2 d_2$
  $d_1 = \left(\dfrac{h_2}{h_1}\right) d_2$
 (ii) No, …………………………………………………….……….……..(01)
  Since, the common surface only rises, the heights of free surfaces from common
  surface does not changes. …………………………………………….......… (01)
 (iii) $d_1 = \left(\dfrac{h_2}{h_1}\right) d_2$ …………………………………………..…………… (01)
  $d_1 = 0.91 \times 1000 \text{ kg m}^{-3}$
  $d_1 = 910 \text{ kg m}^{-3}$

(c) (i) Immiscible with each other. …………………………………………….......… (01)
 (ii) A third liquid immiscible with these two liquids and having higher density should be
  added first into the tube.
  Then the two liquids can be added in either arm and experiment can be conducted. **(01)**

(d) (i) Water / Liquid with higher density.
  To prevent coconut oil / liquid with lower density splitting into two parts. ………... **(02)**
 (ii) Height of free surface of mercury from common surface can be very small hence;
  fractional error will be high
   OR
  Height of coconut oil column will be high hence; it is hard to handle such a long tube.
   (02)

(iii)

(01)

(01)

$\theta < 45°$
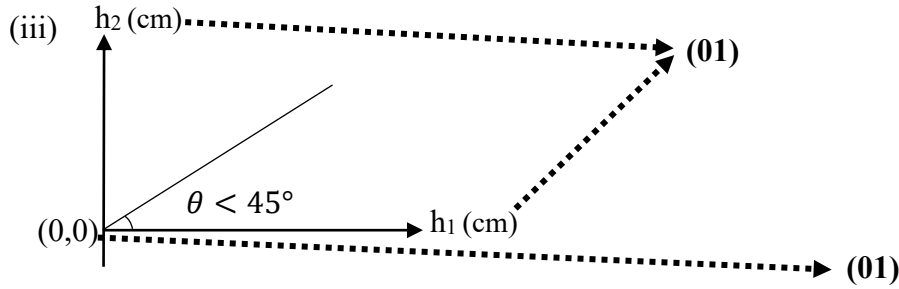
(iv) Densities of two liquids have to be nearly equal. …………………………….... (01)

2. (a) (i) $F = ke$ …………………………………………………………………………. (01)

(ii) Energy $= \frac{1}{2}ke^2$ …………………………………………………………… (01)

(b) $\frac{1}{2}mV_B^2 = \frac{1}{2}kc^2$ …………………………………………………………... (02)

$$V_B^2 = \frac{kc^2}{m}$$

$$V_B = c\sqrt{\frac{k}{m}}$$ ………………………………………………………….. (01)

(c) $F = \mu R$

$F_1 = \mu mg$ ……………………………………………………………………… (02)

(d) (i) $\vec{F} = ma$

$-\mu mg = ma_1$

$a_1 = -\mu g$ …………………………………………………………………… (02)

(ii) $V^2 = U^2 + 2aS$

$V_D^2 = \frac{kc^2}{m} - 2\mu g(b-a)$

$V_D = \sqrt{\frac{kc^2}{m} - 2\mu g(b-a)}$ ………………………………………… (03)

(e) (i) Loss of kinetic energy = Gain in potential energy

$\frac{1}{2}mV^2 = mg \times 2R$ …………………………………………………….. (02)

$V^2 = 4gR$

$V = 2\sqrt{gR}$ ……………………………………………………………… (01)

(ii) $4gR = \frac{kc^2}{m} - 2\mu g(b-a)$ …………………………………………(02)

(f) $\downarrow S = ut + \frac{1}{2}at^2$ $\qquad\qquad \leftarrow S = ut + \frac{1}{2}at^2$

$2R = 0 + \frac{1}{2}gt^2$

$t^2 = \frac{4R}{g}$ $\qquad\qquad\qquad\qquad b = V_E \times 2\sqrt{\frac{R}{g}} + 0$

$t = 2\sqrt{\frac{R}{g}}$ …………….... (02) $\qquad V_E = \frac{b}{2}\sqrt{\frac{g}{R}}$ …………….. (01)

Part B - Essay

3. (a) (i) Dimensions of pressure = [N m^{-2}]

$$= [M L T^{-2} L^{-2}]$$
$$= M L^{-1} T^{-2} \quad ....(01)$$

Dimension of *hdg* = [kg m^{-1} s^{-2}]

$$= M L^{-1} T^{-2} \quad ....(01)$$

So, dimension of pressure = Dimension of *hdg*

(ii) Incompressible ....…… (01)

Non-Viscose ....….. (01)

(b) (i) $P = P_o + h\rho g$ ....….…..... (02)

(ii) Atmosphere air will get inside via the tube A. ....…...…. (02)

(iii) Let density = ρ

Velocity of liquid at cross section $A_1 = \bar{V}$

$P_B = P_o + h_1 \rho g$ .... (1) .... (01)

$P_C = P_o + h_2 \rho g$ .... (2) ....….. (01)

$P_C = P_B + \frac{1}{2} \rho \bar{V}^2$ ....….. (01)

$P_C - P_B = \frac{1}{2} \rho \bar{V}^2$ ....…............... (3) ....…... (01)

(2) – (1) ➡ $P_C - P_B = (h_1 - h_2) \rho g$ .... (4) ....…... (01)

(3) – (4) ➡ $\frac{1}{2} \rho \bar{V}^2 = (h_1 - h_2) \rho g$ ....…...…... (01)

$\bar{V}^2 = 2(h_1 - h_2) g$

$\bar{V} = \sqrt{2(h_1 - h_2)g}$ ....…... (01)

According to the equation of continuity, ...….….... (01)

$A_1 \bar{V} = A_2 V$ ....…... (01)

$V = \frac{A_1}{A_2} \bar{V}$

$V = \frac{A_1}{A_2} \sqrt{2(h_1 - h_2)g}$ ....…... (01)

(c) (i) $P + \frac{1}{2} dv^2 = $ constant ....…....…..... (02)

(ii) The man gets dragged towards the train. ....…... (01)

When the train swifts near the man the air column near the train / between man and train also move fast. Hence, according to Bernoulli's equation the dynamic pressure increases **resulting a low static pressure. An unbalanced force** act on man due to the **pressure difference pushes him towards the train**. ....…... (03)

(iii) Pressure difference = 1×10^5 Pa - 5×10^4 Pa ....…... (01)

$= 5 \times 10^4$ Pa ....…... (01)

Unbalanced force acting on man = 5×10^4 Pa $\times$ 1 m^2 ....(01)

$= 5 \times 10^4$ N ....…... (01)

Applying $F = ma$ for man horizontally,.

$F = ma$ ....…... (01)

5×10^4 N = 50 kg $\times a$

$a = 1000$ ms^{-2} ....…... (01)

எங்கள் குறிக்கோள்

எண்ணிம உலகத்தில் மாணவர்களிற்கென சிறந்தொரு கற்றல் கட்டமைப்பை உருவாக்குதல்.

அனைத்தும் டிஜிட்டல் மயப்படுத்தப்பட்ட இந்த காலத்தில் பல்வேறு துறைகளும் கால ஓட்டத்துடன் இணைந்து டிஜிட்டல் தளத்தில் பல்கிப்பெருகி வருகின்றன. அந்த வகையில் கல்வித்துறையும் இதற்கு விதிவிலக்கல்ல. இணையவழி கல்வியின் மூலம் கல்வித்துறை புதியதொரு பரிமாணத்தை எட்டியுள்ளது. குறிப்பாக கொரோனா பேரிடர் காலத்தில் நாடே முடக்கப்பட்டிருந்தது. இதனால் மாணவர்களிற்கும் பாடசாலை, கல்வி நிறுவனங்களிற்கு இடையிலான தொடர்பு துண்டிக்கப்பட்டது. அந்த இக்கட்டான சூழ்நிலையில் இணையவழி வகுப்புகள் மாணவர்களிற்கு வரப்பிரசாதமாக அமைந்தது என்பதே உண்மை.

இன்று தொழில்நுட்பம் மாணவர்களை தவறான பாதைக்கு இட்டு செல்வதாக ஓர் எண்ண ஓட்டம் மக்கள் மத்தியில் உள்ளது. தொழில்நுட்பம் என்பது ஒரு கருவி மட்டுமே அதை எவ்வாறு பயன்படுத்துகிறோம் என்பதில் அதன் ஆக்க மற்றும் அழிவு விளைவுகள் தீர்மானிக்கப்படுகிறது. உளியை கொண்டு சிலையை செதுக்க நினைத்தால் அவன் நிச்சயம் சிற்பி ஆகலாம். இங்கு பிரச்சினையாக காணப்படுவது மாணவர்களை வழிப்படுத்த தொழில்நுட்ப உலகில் ஓர் முறையான கட்டமைப்பு இல்லாமையே. அதை உருவாக்குவதே எங்கள் நோக்கம். அதை நோக்கியே எங்கள் பயணம் அமையும்.

எமது இணையத்தினூடக ஊடாக உங்களிற்கு தேவையான பரீட்சை வினாத்தாள்களை இலகுவான முறையில் தரவிறக்கம் செய்து கொள்ளமுடியும்.

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கல்வி சார் செய்திகளை உடனுக்குடன் அறிந்து கொள்ள எமது சமூக ஊடக தளங்களின் ஊடாக உடனுக்குடன் அறிந்து கொள்ள முடியும்.

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