TERM-1 EXAMINATION (2026-27)
PHYSICS (042) SET -1
MARKING SCHEME

Class: XI **Time: 3hr**
Date: 02.09.2026 **Max Marks: 70**

Section A (16 X 1M)

1. (b) Pascal
2. (b) 3
3. (b) $[MLT^{-2}]$
4. (a) Zero
5. (b) Displacement
6. (a) -3 m/s
7. (a) Zero
8. (b) 45°
9. (b) $\tan^{-1}(4)$
10. (a) Inertia
11. (c) 5 m/s^2
12. (d) Linear momentum
13. (a) Both A and R are true, and R is the correct explanation of A.
14. (a) Both A and R are true, and R is the correct explanation of A.
15. (d) A is false, but R is true.
16. (a) Both A and R are true, and R is the correct explanation of A.

17. (a) G is **$[M^{-1}L^3 T^{-2}]$**
(b) coefficient of viscosity is **$[M L^{-1} T^{-1}]$.**

18. (a) V-u=at

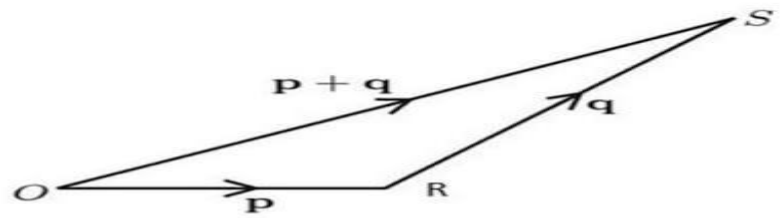
0-20=a x 5

a=4 ms^{-2}

(b) $S= (v^2-u^2)/2a$
S= 0-400/8
S= -50m

19.

Triangular law



Triangle law of vector addition states that when two vectors are represented by two sides of a triangle in magnitude, and direction taken in same order then third side of that triangle represents (in magnitude and direction) the resultant of the vectors.
Thus, OR = p, RS = q, OS = r then OR + RS = OS i.e., p + q = r

OR

R= $\sqrt{(P^2+2PQ\cos\Theta+Q^2)}$

R=$\sqrt{(3^2+0+4^2)}$

R=5 Unit

20.

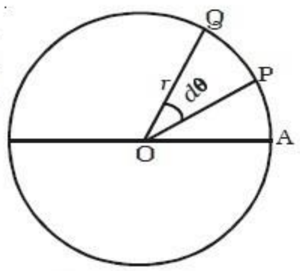
Let us consider a body P moving along the circumference of a circle of radius r with linear velocity v and angular velocity ω as shown in Fig. Let it move from P to Q in time dt and $d\theta$ be the angle swept by the radius vector.

Let PQ = ds, be the arc length covered by the particle moving along the circle, then the angular displacement $d\theta$ is expressed as $d\theta = \frac{ds}{r}$. But $ds = v\,dt$

$\therefore\ d\theta = \frac{v\,dt}{r}$ (or) $\frac{d\theta}{dt} = \frac{v}{r}$

(i.e) Angular velocity $\omega = \frac{v}{r}$ or $v = \omega\, r$

In vector notation, $\vec{v} = \vec{\omega} \times \vec{r}$



Relation between linear velocity and angular velocity

Thus, for a given angular velocity ω, the linear velocity v of the particle is directly proportional to the distance of the particle from the centre of the circular path (i.e) *for a body in a uniform circular motion, the angular velocity is the same for all points in the body but linear velocity is different for different points of the body.*

21.

Newton's Third Law of Motion.
... The forces acting on you as you sit in your chair are just one **example** of **Newton's third law,** which **states** that for every action force there is an equal and opposite reaction force. In fact, all forces come in pairs. No force exists in isolation.

22.

Example:
Let's check the kinematic equation:

$s = ut + \frac{1}{2}at^2$

- s is displacement (dimension: L)
- u is velocity (dimension: LT^{-1})
- a is acceleration (dimension: LT^{-2})
- t is time (dimension: T)

Checking each term:

- $ut \rightarrow (LT^{-1}) \times (T) = L$
- $\frac{1}{2}at^2 \rightarrow (LT^{-2}) \times (T^2) = L$

So all terms on the RHS and the LHS have the same dimension: length (L), and the equation is dimensionally consistent.

23.

Let Time period =T
Mass of the bob = m
Acceleration due to gravity = g
Length of string = L

Let $T \alpha m^a g^b L^c$
$[T] \alpha [m]^a [g]^b [L]^c$
$M^0 L^0 T^1 = M^a L^b T^{-2b} L^c$
$M^0 L^0 T^1 = M^a L^{b+c} T^{-2b}$
$\Rightarrow$ a=0 $\Rightarrow$ Time period of oscillatio
is independent of mass of the bob

-2b=1
$\Rightarrow$ b=$-\frac{1}{2}$

b+c = 0
$-\frac{1}{2}$ + c =0
c=$\frac{1}{2}$

Giving values to a,b and c in first equation
$T \alpha m^0 g^{-\frac{1}{2}} L^{\frac{1}{2}}$
$T \alpha \sqrt{\frac{L}{g}}$

24.

If we draw AD parallel to OC, we observe that
BC = BD + DC = BD + OA
Substituting, BC with v and OA with u,
we get

$v = \text{BD} + u$

or $\quad \text{BD} = v - u \qquad$ ...(1)

Thus, from the given velocity-time graph, the acceleration of the object is given by

$a = \frac{\text{Change in velocity}}{\text{Time taken}}$

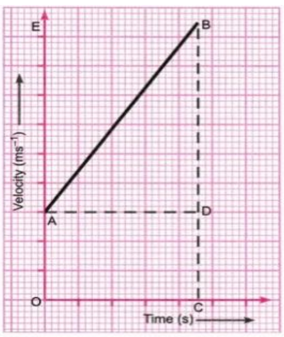
$= \frac{\text{BD}}{\text{AD}} = \frac{\text{BD}}{\text{OC}}$

Substituting, OC with t, we get

$a = \frac{\text{BD}}{t}$ or $\text{BD} = at \qquad$ ...(2)

From equations (1) and (2), we have

$\boldsymbol{v - u = at}$ **or** $\boldsymbol{v = u + at}$



25. (i)

$$u = -29.4\ \text{ms}^{-1},\ a = 9.8\ \text{ms}^2,\ v = 0$$

As, $v^2 - u^2 = 2as \Rightarrow 0 - (29.4)^2$

$$= 2 \times 9.8 \times s$$

or, $s = \dfrac{-(29.4)^2}{2 \times 9.8} = -44.1\ \text{m}$

Also, $v = u + at \Rightarrow v - u = at$

or, $t = \dfrac{29.4}{9.8} = 3s$

$\Rightarrow 0 - (-29.4) = 9.8 \times t$

(ii)

$$v^2 - u^2 = 2gs$$

$$s = \frac{v^2 - u^2}{2g}$$

$$= \frac{(0)^2 - (29.4)^2}{2 \times (-9.8)} = 44.1\text{m}$$

(iii) Total time taken to retunn the ground- 6s

26. (a)

$$H = ut + \frac{1}{2}gt^2$$

$$H = V_0 \sin\theta\left(\frac{V_0 \sin\theta}{g}\right) + \frac{1}{2}(-g)\left(\frac{V_0 \sin\theta}{g}\right)^2$$

$$H = \frac{V_0^2 \sin^2\theta}{g} - \frac{V_0^2 \sin^2\theta}{2g}$$

$$H = \frac{2V_0^2 \sin^2\theta - V_0^2 \sin^2\theta}{2g}$$

$$H = \frac{V_0^2 \sin^2\theta}{2g}$$

Or

b.

$$R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$$

Or,

$$x^2 = x^2 + x^2 + 2x^2\cos\theta$$

Or,

$$-x^2 = 2x^2\cos\theta$$

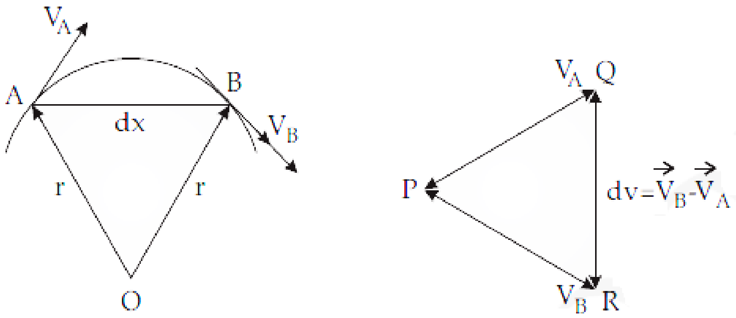
After solving

$$\cos\theta = -\tfrac{1}{2}$$

Therefore,

$$\theta = 120^\circ$$

27.



From fig (1) $\dfrac{AB}{AO} = \dfrac{PQ}{PR}$

$$\frac{\Delta v}{v} = \frac{\Delta x}{r}$$

$$\Delta v = \frac{\Delta x v}{r}$$

$$\text{Acceleration} = \lim \Delta t \rightarrow 0 \ \frac{\Delta v}{\Delta t} = \frac{dv}{dt} = \frac{v}{r}\frac{dx}{dt}$$

$$= \frac{v^2}{r}$$

$$\therefore \ a = \frac{v^2}{r}.$$

28. **Newton's second law of motion** states that the time rate of change of linear momentum of an object is directly proportional to the applied external unbalanced force, and this change takes place in the direction of the applied force. Mathematically, it is expressed as $F = ma$, where F represents the net force acting on the object, m represents its constant mass, and a represents the resulting acceleration

$$F \propto \frac{\text{Change in momentum}}{\text{Time}}$$

$$F \propto \frac{mv - mu}{t}$$

$$F \propto m\left(\frac{v-u}{t}\right)$$

$$\Rightarrow F \propto ma \ \Rightarrow \ F = kma \left(\because a = \frac{v-u}{t}\right)$$

$$\Rightarrow F = ma \quad (\because K = \text{constant} = 1)$$

29. (i) 20 m/s
(ii) 100m
(iii) 400m
(iv) 4 m/s^2

30. (i) When the lift is **stationary**, the weighing machine reads **(588 N)** or **600 N** if taking g = 10 m/s^2.
R= m(g+a)
(ii) When accelerating upwards at **$2 m/s^2$** the machine reads 708 N or 720 N if $g=10 m/s^2$
(iii) Zero Newton
31. (a) The law of conservation of linear momentum states that the total linear momentum of an isolated system remains constant if no external force acts on it. This means the total momentum before a collision equals the total momentum after.

Change in momentum of A is: $m_1(v_1 - u_1)$

Change in momentum of B is: $m_2(v_2 - u_2)$

According to third law of motion,

$F_{BA} = - F_{AB}$

$F_{BA} = m_2 \times a_2 = \frac{m_2(v_2 - u_2)}{t}$

$F_{AB} = m_1 \times a_1 = \frac{m_1(v_1 - u_1)}{t}$

Here, a_1 & a_2 are the acceleration of A and B.

Therefore,

$\frac{m_2(v_2 - u_2)}{t} = - \frac{m_1(v_1 - u_1)}{t}$

$m_2(v_2 - u_2) = - m_1(v_1 - u_1)$

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

mu = Mv′+ mv ....(1)

Again applying work – energy principle for the block after the collision

$0 - (1/2)\, M \times V'^2 = - Mgh$ (where h = 0.2m)

$\Rightarrow V'^2 = 2gh$

$V' = \sqrt{2gh} = \sqrt{20 \times 0.2} = 2$m/sec

Substituting the value of V′ in the equation (1), we get\

$0.02 \times 300 = 0.5 \times 2 + 0.2 \times v$

$\Rightarrow V = \frac{6.1}{0.02} = 250$m/sec.

OR

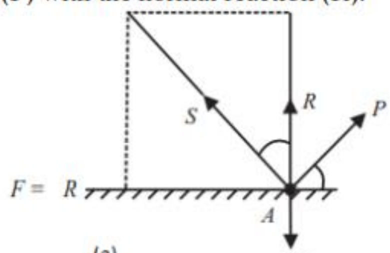
(a) Angle of Friction (θ) It is defined as the angle made by the resultant of the normal reaction (R) and the limiting force of friction (F) with the normal reaction (R).

Let, S = Resultant of the normal reaction (R) and limiting force of friction (F)

θ = Angle between S and R

Tan θ = F/R = μ

Note: The force of friction (F) is always equal to μR



(a)

b) Angle of Repose (α) It is the max angle of inclined plane on which the body tends to move down the plane due to its own weight.

Consider the equilibrium of the body when body is just on the point of slide.

Resolving all the forces parallel and perpendicular to the plane, we have:

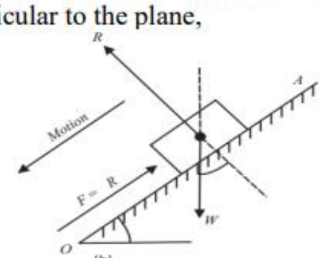
μR = W.sina

R = W.cosa

Dividing 1 by 2 we get T ana μ

But μ = tan θ, θ = Angle of friction

i.e., θ = α



(b)

The minimum force required to move the body is $F_s = \mu_s N$

$F_s = 0.4 \times 10 \times 10$

$F_s = 40N$

32.

$$\Rightarrow \int_0^t a dt = \int_u^v dv \Rightarrow at = v - u \Rightarrow v = u + at$$

Which gives us the first equation of motion.

Also, velocity can be written as

$$v = \frac{ds}{dt} \Rightarrow ds = vdt$$

Substituting $v = u + at$

$ds = (u + at)dt$

$ds = (udt + atdt)$.

Integrating both sides (displacement from 0 to s, time from 0 to t)

$$\int_0^s ds = \int_0^t udt + \int_0^t atdt$$

$$s = ut + \frac{1}{2}at^2$$

$a = \frac{dv}{dt}$, dv is the velocity change in time dt

Also, velocity $v = \frac{ds}{dt}$, ds indicates displacement undergone in time dt.

Dividing a by v,

$\frac{a}{v} = \frac{dv}{ds} \Rightarrow ads = vdv$;

integrating

$a\int_0^s ds = \int_u^v vdv$

$as = \frac{v^2}{2} - \frac{u^2}{2} \Rightarrow v^2 = u^2 + 2as.$

OR

$y = u_1 t + \frac{1}{2} a_1 t^2$

$= 0 \times t + \frac{1}{2} \times 10 \times t^2$

$y = 5t^2$ ______(1)

$(100 - y) = u_2 t + \frac{1}{2} a_2 t^2$

$= 25t + \frac{1}{2} \times (-10) \times t^2$

$= 25t - 5t^2$

or, $100 - y = 25t - 5t^2$ ______(2)

Adding (1) and (2)

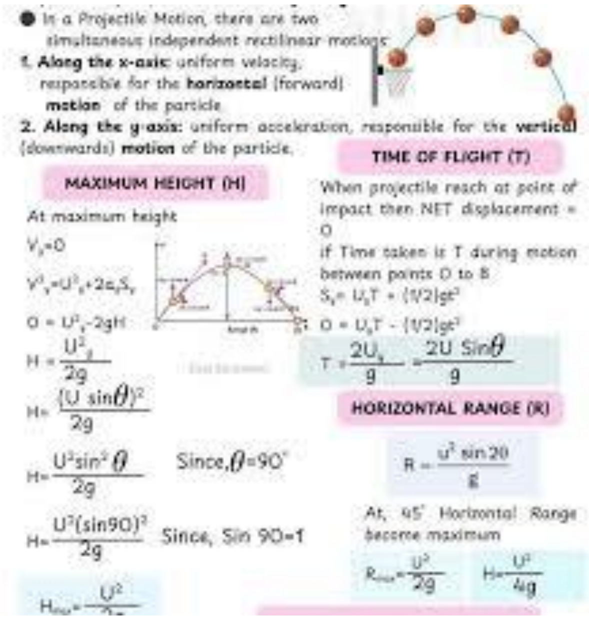
$100 = 25t$

$t = \frac{100}{25} = 4$ s.

Substiting value of t in(1) we get

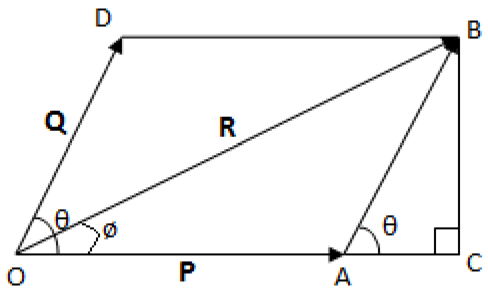
$y = 5 \times 4^2 = 80$ m

33.



In a Projectile Motion, there are two simultaneous independent rectilinear motions:
1. Along the x-axis: uniform velocity, responsible for the horizontal (forward) motion of the particle
2. Along the y-axis: uniform acceleration, responsible for the vertical (downwards) motion of the particle.
MAXIMUM HEIGHT (H)
At maximum height
$V_y = 0$
$V_y^2 = U_y^2 + 2a_yS_y$
$0 = U_y^2 - 2gH$
$H = \frac{U_y^2}{2g}$
$H = \frac{(U\sin\theta)^2}{2g}$
$H = \frac{U^2\sin^2\theta}{2g}$ Since, $\theta = 90^\circ$
$H = \frac{U^2(\sin 90)^2}{2g}$ Since, Sin 90=1
TIME OF FLIGHT (T)
When projectile reach at point of impact then NET displacement = 0
if Time taken is T during motion between points O to B
$S_y = U_yT + (1/2)gt^2$
$0 = U_yT - (1/2)gt^2$
$T = \frac{2U_y}{g} = \frac{2U\sin\theta}{g}$
HORIZONTAL RANGE (R)
$R = \frac{u^2\sin 2\theta}{g}$
At, 45° Horizontal Range become maximum
$R_{max} = \frac{U^2}{2g}$
$H = \frac{U^2}{4g}$

OR



D
B
Q
R
θ
ø
θ
O
P
A
C

Let the two vectors be represented in magnitude and direction by two adjacent sides $\overrightarrow{OP}$ and $\overrightarrow{OS}$ of parallelogram OPQS, drawn from a point O.

According to the parallelogram law of vectors, thier resultant vector $\vec{R}$ will be represented by disgnol $\overrightarrow{OQ}$ of the parallelogram.

Manitude of $\vec{R}$:

Draw QN perpendicular to OP produced.

From the figure, OP = A, OS = PQ = B, OQ = R and $\angle SOP = \angle QPN = \theta$

In ΔQNP, $PN = PQ\cos\theta = B\cos\theta$

$QN = PQ\sin\theta = B\sin\theta$

In right angled triangle, ONQ, we have

$OQ^2 = ON^2 + NQ^2$

$= (OP + PN)^2 + NQ^2$

or $R^2 = (A + B\cos\theta)^2 + (B\sin\theta)^2$

or $R^2 = A^2 + 2AB\cos\theta + B^2(\cos^2\theta + \sin^2\theta)$

or $R^2 = A^2 + 2AB\cos\theta + B^2$

or $R = \sqrt{A^2 + 2AB\cos\theta + B^2}$

$R= \sqrt{(P^2+2PQ\cos\Theta +Q^2)}$

$R=\sqrt{(8^2+2x8x6x0.5 +6^2)}$

R=12.57 N

______________________________END OF THE MARKING KEY________________________________