No. of pages - 12 **(M)**

MARKING SCHEME
COMMON ANNUAL SCHOOL EXAMINATION (2022-23)
CLASS : XI
SUBJECT: PHYSICS (042)

Time Allowed : 3 hours **Maximum Marks : 70**

Section-A

1.	(b)	Kinetic energy	1
2.	(d)	4 s	1
3.	(a)	at rest	1
4.	(b)	Horizontal range	1
5.	(c)	tan θ	1
6.	(b)	the vertical component of the pulling force acts in the opposite direction of weight.	1
7.	(b)	Angular momentum	1
8.	(a)	the angular velocity increases	1
9.	(c)	W/4	1
10.	(d)	Elastomer	1
11.	(b)	Zero	1
12.	(d)	22.5 g	1
13.	(a)	The region AB represents ice & water in thermal equilibrium	1

14. (c) Zeroth law of thermodynamics 1

15. (a) (3/2) RT 1

$$KE = \frac{3}{2} \times nRT$$

Above formula is given for n moles

So for 1 mole n = 1

$$KE\ \frac{3}{2} \times 1 \times RT$$

$$KE\ \frac{3}{2} \times RT\ .$$

Hence option A is correct.

16. (a) Both (A) and (R) are true and (R) is the correct explanation of (A). 1

17. (a) Both (A) and (R) are true and (R) is the correct explanation of (A). 1

18. (d) (A) is false but (R) is true. 1

Section-B

19. $\frac{\nu_1}{\nu_2} = \frac{\tan 30°}{\tan 45°}$ 1

$\frac{\nu_1}{\nu_2} = \frac{1}{\sqrt{3}}$ 1

20. (a) Repeated bending of wire decreases elastic strength and therefore it can be broken easily. 1

(b) The density of sea water is more than the density of river water, hence sea water gives more upthrust for the same volume of water displaced. 1

21. Correct derivations 1+1

OR

Maximum height $H = \frac{u^2 \sin^2 \theta}{2g}$ 1

$H = \frac{28^2 \times 0.5^2}{2 \times 9.8} = 10\text{m}$

Time of flight $T = \frac{2u \sin \theta}{g}$ 1

$T = \frac{2 \times 28 \times \sin 30}{9.8} = 2.86\text{s}$

22. By work – Energy Thoerem. 1

Loss in K.E. = W.D. against the force

OR K.E. = μ mg S 1

For constant K.E., $S \alpha \frac{1}{m}$

Truck will stop in a lesser distance.

23. Fig. (a) is incorrect. According to equation of continuity, i.e., av = Constant, where area of cross-section of tube is less, the velocity of liquid flow is more. So the velocity of liquid flow at a constriction of tube is more than the other portion of tube. 1

According to Bernoulli's Theorem,

$$P + \frac{1}{2}\rho v^2 = \text{constant},$$

where v is more, P is less and vice versa.

OR

When air is blown into the narrow end its velocity in the region between filter paper and glass increases. This decreases the pressure. The filter paper gets more firmly held with the wall of the funnel. 2

24. When a piston is pulled out the volume of the gas increases. Now the number of molecules colliding against the wall of the container per unit area decreases. Hence pressure decreases. 2

25. $$v = \sqrt{\frac{\gamma P}{\rho}} \qquad ...(i)$$

where,

Density, ρ = Mass/Volume = M/V

M = Molecular weight of thegas

V = Volume of the gas

Hence, equation (i) reduces to : 1

$$v = \sqrt{\frac{\gamma PV}{m}} \qquad ...(ii)$$

Now from the ideal gas equation for n = 1:

PV = RT

For constant T, PV= Constant

Since both M and y are constants, v= Constant

Hence, at a constant temperature, the speed of sound in a gaseous medium is independent of the change in the pressure of the gas. 1

Section-C

26. (a) (i) Parsec 1

(ii) [L]

(b) Calorie = $M1^2T^{-2}$ = 4.2 Joules

$\Rightarrow ab^2c^{-2} \times$ calorie = 4.2 J 1

$$\text{Calorie} = \frac{4.2c^2}{ab^2}$$

27. Correct proof of Bernoulli's theorem. 2

Any two correct applications of this theorem. 1

OR

Correct Definition of terminal velocity. 1

Correct expression for terminal velocity of a sphere falling through a viscous liquid. 2

28. Bats emit ultrasonic waves of very small wavelength (high frequencies) and so high speed. The reflected waves from an obstacle in their path give them an idea about the distance, direction, nature and size of the obstacle. 3

OR

Because the density of water vapour is less than that of the dry air hence density of air decreases with the increase of water vapours or humidity and velocity of sound inversely proportional to square root of density $v \propto \frac{1}{\sqrt{\rho}}$ 3

29. Correct proof 3

OR

Correct proof 3

30. Correct statement 1

Correct derivation 2

Section-D

31. (a) Just to avoid the bullet hitting below the target, the barrel of the gun is lined up little above the target, so that the bullet, after travelling in parabolic path hits the distant target. 2

(b) (i) $R = \frac{u^2 \sin 2(45° + \alpha)}{g}$

$$= \frac{u^2 \sin(90° + 2\alpha)}{g}$$

$$= \frac{u^2 \cos 2\alpha}{g}$$ 1½

(ii) When the angle of projection, $\theta = 45° - \alpha$, horizontal range is

$$R' = \frac{u^2 \sin 2(45° - \alpha)}{g}$$

$$= \frac{u^2 \sin(90°° - 2\alpha)}{g}$$

$$= \frac{u^2 \cos 2\alpha}{g}$$ 1½

Clearly, R' = R

OR

(a) Correct derivation of $v = r\omega$ 2

(b) Time taken by hour hand for one rotation is 12 hrs

So, $\omega_H = \frac{2\pi}{12}$ rad / hr ...(i) 1

Time taken by Earth for one rotation is 24 hrs.

So, $\omega_E = \frac{2\pi}{24}$ rad / hr 1

Hence, required ratio is

$$\frac{\omega_H}{\omega_E} = \frac{\frac{2\pi}{12}}{\frac{2\pi}{24}} = \frac{24}{12} = 2:1$$ 1

32. (a) Correct derivation 2

(b) (i) $vo = (R\ g \tan\theta)^{1/2}$

Here R = 300 m, $\theta = 15°$, g = 9.8 ms^{-2}; we have

vo = 28, 1 ms^{-1}

Maximum permissible speed v max

$$v_{max} = \left(Rg \frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta} \right)^{1/2} = 38.1\ ms^{-1}$$ 2

OR

(a) Correct definition of angle of friction (θ) and angle of repose (ϕ)

Correct proof of $\theta = \phi$. 1+1+1

(b) Given $\mu = \sqrt{3}$; Also $+ = \tan\theta$

$\tan\theta = \sqrt{3}$ 1

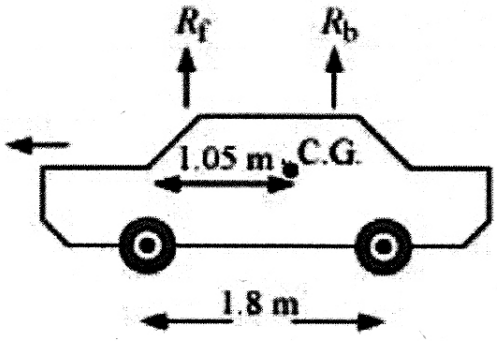
$\theta = 60°$

Hence, the angle is 60° 3

33. a) When the child gets up and runs about on the trolley, the speed of the centre of mass of the trolley and child remains unchanged irrespective of the manner of motion of the child. It is because here child and

trolley constitute one single system and forces involved are purely internal forces. As there is no external force, there is no change in momentum of the system and velocity remains unchanged. 2

b) 1



At translational equilibrium,

$R_f + R_b = mg$ 1

$= 1800 \times 9.8$

$= 17640$ N ...(i)

For rotational equilibrium, on taking the torque about the C.G., we have

$R_f (1.05) = R_b (1.8 - 1.05)$

$$\frac{R_b}{R_f} = \frac{7}{5}$$

$R_b = 1.4\ R_f$ ...(ii) 1

Each front wheel = 375 kg and

Each rear wheel = 525 kg

OR

(a) Correct derivation of M.I = 2 × Rotational K.E. 2

(b) Here M = 1 kg, R = 0.2 m 1

$$v = \frac{30}{\pi}\text{rpm} = \frac{1}{2\pi}\text{rps}$$

$$\omega = 2\pi v = 2\pi \times \frac{1}{2\pi} = 1 \text{ rad / sec}$$ 1

MI of the disc about an axis through its centre and perpendicular to its plane.

$$I = \frac{1}{2}MR^2 = \frac{1}{2} \times 1 \times (0.2)^2 = 0.02\text{kgm}^2$$ 1

Rotational KE = $\frac{1}{2}I\omega^2 = \frac{1}{2} \times 0.02 \times 1^2 = 0.01\text{J}$

Section-E

34. (a) (ii) Doubled 1

$M_1 = M_2$

$$\frac{W_1}{g_1} = \frac{W_2}{g_2}$$

$$\frac{W_1}{g_1} = \frac{W_2}{2g_1}$$

$W_2 = 2 \times W_1$

(b) (iv) All above materials will have same acceleration 1

(c) (i) 9.8 Newton 2

Since, weight of the body = mg

$\Rightarrow$ = Mass = Weight/g = 9.8/9.8 = 1 kg

We know that,

$F = m \times a$

$\Rightarrow F = 1 \text{ kg} \times 9.8 \text{ m/s}^2$

$\Rightarrow F = 9.8$ Newton

OR

(i) Weight of the girl (W) = 450 N

$W = m\,g = m \times 9.8 = 450$

So ass of the girl (m) = 450/9.8 = 45.9 kg.

35. (i) (b) Maximum 1

(ii) (b) $T = 2\pi/\omega$ 1

$\sin \omega t - \cos \omega t$

$= \sin \omega t - \sin (\pi/2 - \omega t)$

$= 2 \cos (\pi/4) \sin (\omega t - \pi/4)$

$= \sqrt{2} \sin (\omega t - \pi/4)$

This function represents a simple harmonic motion having a period T $= 2\pi/w$

(iii) (c) The stone executes simple harmonic motion about the centre of the earth 2

OR

(d) Let $y = A \sin \omega t$

i.e. $\frac{A}{\sqrt{2}} A \sin \omega t$

$\Rightarrow \sin \omega t = \frac{1}{\sqrt{2}} = \sin \frac{\pi}{4}$

i.e. $\omega t = \frac{\pi}{4}$

But $\omega = \frac{2\pi}{T}$

Therefore, $t = \frac{T}{8}$