COMMON QUARTERLY EXAMINATION - 2024

Standard XI

Reg.No. | | | | | | |

PHYSICS

Time : 3.00 hrs *Marks : 70*

Part - I

15 x 1 = 15

I. Choose the correct answer:

1. Round of the following number 19.95 into three significant figures.
   a) 19.9 b) 20.0 c) 20.1 d) 19.5
2. The dimensional formula of energy is
   a) ML^2T^{-2} b) ML^2T^{-3} c) ML^2T^{-1} d) ML^3T^{-2}
3. The dimension of $(\mu_o\varepsilon_o)^{-1/2}$ is
   a) length b) time c) force d) velocity
4. Identify the unit vector in the following
   a) $\hat{i}+\hat{j}$ b) $\frac{\hat{i}}{\sqrt{2}}$ c) $\hat{k}-\frac{\hat{j}}{\sqrt{2}}$ d) $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$
5. If an object is thrown vertically up with the initial speed U from the ground, then the time taken by the object to return back to ground is
   a) $\frac{U^2}{2g}$ b) $\frac{2U}{g}$ c) $\frac{U}{2g}$ d) $\frac{U^2}{g}$
6. Two objects of masses m_1 and m_2 fall from the heights h_1 and h_2 respectively. The ratio of the magnitude of their moment a when they hit the ground is
   a) $\sqrt{\frac{h_1}{h_2}}$ b) $\sqrt{\frac{m_1 h_1}{m_2 h_2}}$ c) $\frac{m_1}{m_2}\sqrt{\frac{h_1}{h_2}}$ d) $\frac{m_1}{m_2}$
7. The centrifugal force appears to exist
   a) only in inertial frames b) only in rotating frames
   c) in any accelerated frame d) both in inertial and non-inertial frames
8. Two masses m_1 and m_2 are experiencing the same force where $m_1 < m_2$. The ratio of their acceleration $\frac{a_1}{a_2}$ is
   a) 1 b) greater than 1
   c) less than 1 d) all the three cases

9. Force acting on the particle moving with constant speed is
   a) need not be zero b) always zero
   c) always non zero d) cannot be concluded
10. A ball of mass 1 kg and another of mass 2 kg are dropped from a tall building whose height is 80 m. After a fall of 40 m each towards Earth their respective kinetic energies will be in the ratio of
   a) $\sqrt{2}:1$ b) $1:\sqrt{2}$ c) 2 : 1 d) 1 : 2
11. The work done by the conservative force for a closed path is
   a) always negative b) zero
   c) always positive d) not defined
12. If the linear momentum of the object is increased by 0.1% then the kinetic energy is increased by
   a) 0.2% b) 0.4% c) 0.1% d) 0.01%
13. A couple produces
   a) pure rotation b) pure translation
   c) rotation and translation d) no motion
14. A rigid body rotates with an angular momentum L. If its kinetic energy is halved the angular momentum becomes
   a) L b) $\frac{L}{2}$ c) 2L d) $\frac{L}{\sqrt{2}}$
15. The speed of the centre of the wheel rolling on a horizontal surface is V_o. A point on the rim in level with the centre will be moving at a speed of
   a) zero b) V_o c) $\sqrt{2}V_o$ d) $2V_o$

Part - II

II. Answer any 6 questions. (Q.No.24 is compulsory) **6 x 2 = 12**

16. Define precision and accuracy. Explain with one example.
17. Define one Newton.
18. What are the limitations of dimensional analysis?

19. Write down the kinematic equations for angular motion.
20. What is the condition for pure rolling?
21. State the empirical laws of static and kinetic friction.
22. Define coefficient of restitution.
23. How do you deduce that two vectors are perpendicular?
24. What are the resultants of the vector product of two given vectors is given by $\vec{A} = 4\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{B} = 5\hat{i} + 3\hat{j} - 4\hat{k}$

Part - III

III. Answer any 6 questions. (Q.No.33 is compulsory) **6 x 3 = 18**

25. State Kepler's three laws.
26. Prove that the path followed by the projectile is a parabola.
27. Discuss the properties of scalar products.
28. Using free body diagram, show that it is easy to pull an object than to push it.
29. Explain the similarities and differences of centripetal and centrifugal forces.
30. Arrive at an expression for power and velocity.
31. State and prove Parallel Axis Theorem.
32. Write the applications of Dimensional analysis.
33. A car takes a turn with velocity 50 ms^{-1} on the circular road of radius of curvature 10 m. Calculate the centrifugal force experienced by a person of mass 60 kg inside the car.

Part - IV

IV. Answer all the questions. **5 x 5 = 25**

34. a) Derive the expression for moment of Inertia of a rod about its centre and perpendicular to the rod.

(OR)

b) State and explain work-energy principle.

35. a) Briefly explain the origin of friction. Show that in an inclined plane angle of friction is equal to angle of repose.

(OR)

b) Prove the law of conservation of linear momentum. Use it to find the recoil velocity of a gun when a bullet is fired from it.

36. a) Explain in detail the triangle law of addition.

(OR)

b) What do you mean by propagation of error. Explain the propagation of errors in multiplication.

37. a) Discuss conservation of angular momentum with example.

(OR)

b) Explain in detail the various types of errors.

38. a) Derive the kinematic equations of motion for constant acceleration.

(OR)

b) What is inelastic collision? In which way, it is different from elastic collision. Mention few examples in day-to-day life for inelastic collision.

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Common Quarterly Examination - 2024

Physics

Key points

(Part - A)

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1) (a) 19.9

2) (a) ML^2T^{-2}

3) (d) velocity

4) (d) $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$

5) (b) $\frac{2u}{g}$

6) $\frac{m_1}{m_2}\sqrt{\frac{h_1}{h_2}}$ (c)

7) only in rotating frames. (b)

8) greater than 1. (b)

9) need not be zero (a)

10) (d) 1:2

11) (b) zero

12) (a) 0.2 %

13) (a) pure rotation

14) (d) $\frac{L}{\sqrt{2}}$

15) (c) $\sqrt{2}V_0$

Part - B.

(Q.24 Compulsory)

16) Exact values of measurement.

(e-g) Temperature 23.5 F° 23.8 F°

17) $F = 1N$

$m = 1Kg$

$a = 1 m/s^2$

18) log, sin, cos, π etc ....

Compare to physical quantities.

19) $v = v_0 + at$, $v^2 = v_0^2 + 2a\theta$

$\theta = \omega t + \frac{1}{2} a t^2$

20) Condition:

Translational + Rotational motion.

21) (i) static friction $f_s = \mu_s N$ (ii) Kinetic friction $f_k = \mu_k N$

22) $e = \frac{(v_2 - v_1)}{(u_1 - u_2)}$

23) If the scalar product of two vectors are zero.

$\bar{a} \cdot \bar{b} = 0$ $\bar{a} \cdot \bar{b} = |a||b| \cos\theta$

$\cos\theta = 90^\circ = 0$

24) $\bar{R} = \bar{A} + \bar{B}$

$\bar{R} = (2\bar{i} - 2\bar{j} + \bar{k}) + (5\bar{i} + 3\bar{j} - 4\bar{k})$

$\bar{R} = (9\bar{i} + \bar{j} - 3\bar{k})$

Part - C

(Q.33 Compulsory)

26) 26b)

$u_x = u\cos\theta$, $u_y = u\sin\theta$, $a_x = 0$, $a_y = -g$

$x = u\cos\theta \cdot t \qquad t = \frac{x}{u\cos\theta} \qquad y = u\sin\theta . t - \frac{1}{2}gt^2$

25) 25)

Kepler's laws

Law - I	Law II	Law III
Law of orbit	Law of area	Law of period
Sun at one foci.	Equal area in equal interval of time	$T^2 \propto a^3$ $\frac{T^2}{a^3}$ = constant

27) Scalar product of vector.

$\bar{A}\cdot\bar{B} = \bar{B}\cdot\bar{A}$, $\bar{A}\cdot(\bar{B}+\bar{C}) = \bar{A}\cdot\bar{B} + \bar{A}\cdot\bar{C}$

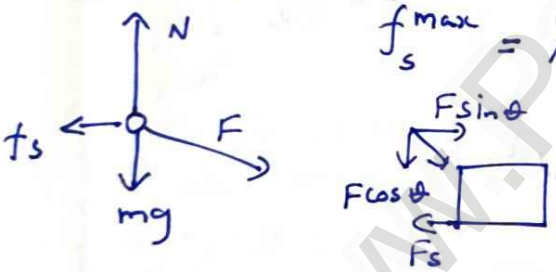
$\theta = 0^\circ$ $\bar{A}\cdot\bar{B} = -AB$ $\qquad$ $\theta = 180^\circ$ $\bar{A}\cdot\bar{B} = AB$

$\bar{i}\cdot\bar{i} = \bar{j}\cdot\bar{j} = \bar{k}\cdot\bar{k} = 1$

28)

(0 to $\pi/2$) $\qquad N_{push} = mg + F\cos\theta$

$f_s^{max} = \mu_s N_{push} = \mu_s (mg + F\cos\theta)$



29)

(i) real force	(i) pseudo force
(ii) non-inertial frame	(ii) Inertial frame.
(iii) $F_{cp} = mw^2r = \frac{mv^2}{r}$	(iii) $F_{cf} = mw^2r = \frac{mv^2}{r}$
(iv) real effect	(iv) real effects.

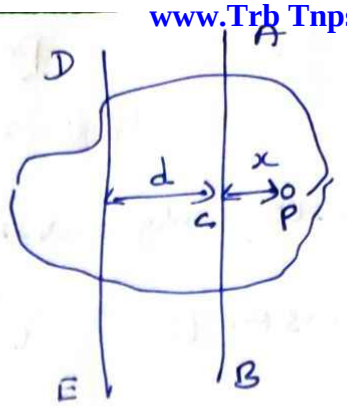
30)

$W = \int F\cdot dr$, $W = \int dw = \int \frac{dw}{dt}.dt$

$\int F\cdot dr = \int (\bar{F}\cdot\bar{v})\,dt$, $\frac{dw}{dt} - F\cdot v = 0$ (or) $\frac{dw}{dt} = F\cdot v = P$

31) parallel axes theorem.

$$I = \sum m(x+d)^2$$



32) Applications of Dimensional analysis

(i) Convert physical Quantity from one to another

(ii) check dimensional correctness.

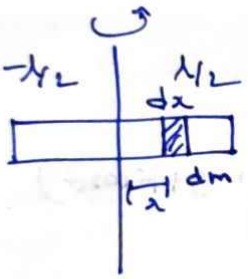
(iii) relation between physical quantities.

33) $F = \frac{mv^2}{r} = \frac{60 \times (50)^2}{10} = \frac{60 \times 2500}{10} = 60 \times 250$

$$F = 15,000\ N$$

Part - D

34) a)



$$dI = dm\,x^2 \qquad I = \frac{M}{l}\int x^2 dx$$

$$\lambda = \frac{M}{l}$$

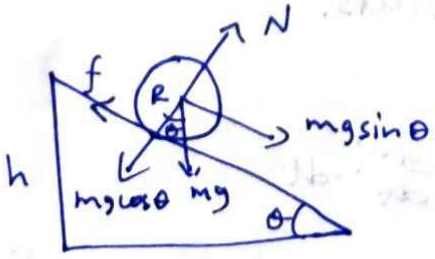
$$I = \frac{1}{12} Ml^2$$

34) (b) work - energy principle

$W = F \cdot S$, $F = ma$, $v^2 = u^2 + 2as$, $a = \frac{v^2 - u^2}{2s}$

$$W = \frac{1}{2}mv^2 - \frac{1}{2}mu^2 \qquad W = \Delta KE$$

35 a)



$$mg\sin\theta - f = ma$$

$$Rf = I\alpha$$

$$a = \frac{g\sin\theta}{\left(1 + \frac{k^2}{R^2}\right)}$$

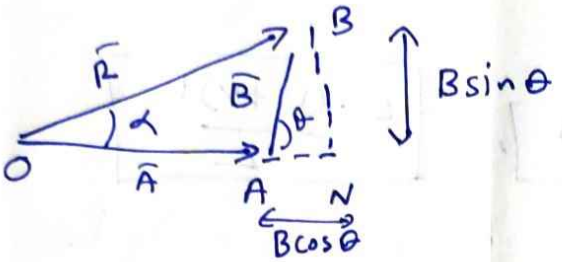
$$v = \sqrt{\frac{2gh}{\left(1 + \frac{k^2}{R^2}\right)}}$$

35 (b) Conservation of linear momentum (5)

$\bar{P_1} = 0 \quad \bar{P_2} = 0 \quad \bar{P_1} + \bar{P_2} = 0.$

$\bar{P_1} = -\bar{P_2}$ ($-\bar{P_2}$ recoil momentum)

36) (a) triangler Law of vector addition



$\bar{OQ} = \bar{OP} + \bar{PQ}$

$\cos\theta = \frac{AN}{B} = B\cos\theta$

$\sin\theta = \frac{BN}{B} = B\sin\theta$

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

$\alpha = \tan^{-1}\left(\frac{B\sin\theta}{A + B\cos\theta}\right)$

36 (b) Propagation of error (Multiplication.)

(i) errors in individual measurement

(ii) nature of mathematical operation.

$\frac{\Delta Z}{Z} = \pm\left(\frac{\Delta A}{A} + \frac{\Delta B}{B}\right)$

37) (a) Conservation of angular momentum

$I = 0$ then $\frac{dL}{dt} = 0$ L = constant.

(e-9) Rotational motion of objects

37 (b) Types of errors

(i) systematic error (ii) Gross error (iii) Random error

Classifications

$a_m = \frac{a_1 + a_2 + \cdots a_n}{n}$

(i) Least count error

(ii) imperfection in procedure.

(iii) Instrumental error.

38) (a) Kinematic Equation.

(i) Velocity - time relation

$$a = \frac{dv}{dt}$$

$$\boxed{v = u + at}$$

(ii) Displacement - time relation.

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

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

(iii) Velocity - displacement relation.

$$a = \frac{dv}{ds}\frac{ds}{dt}$$

$$\boxed{v^2 = u^2 + 2as}, \quad \boxed{s = \frac{(u+v)t}{2}}$$

38 (b) Inelastic collision.

(i) conservation of momentum.

(ii) Kinetic energy not conserved. (✗)

(e-g) Energy transfered in the form of sound, heat light etc.

All non-elastic body collisions.

— X —