BLUE PRINT FOR MODEL QUESTION PAPER – 1

SUBJECT : PHYSICS (33) **CLASS : I PUC**

Blue print for Model question paper –I PUC-PHYSICS									
Unit	**Chapter**	**Topic**	**Teaching Hours**	**Marks allotted**	**10**	**8**	**8**	**3+3**	**5**
					1 mark (VSA)	**2 mark (SA1)**	**3 mark (SA2)**	**5 mark (LA)**	**5 mark (NP)**
I	1	Physical world	2	2		√			
	2	Units and measurement	4	3	√	√			
II	3	Motion in a straight line	8	7		√		√	
	4	Motion in a plane	12	11	√	√	√		√
III	5	Laws of motion	11	10		√	√	√	
IV	6	Work energy and power	11	9	√		√		√
V	7	System of particles and rigid body	12	11	√			√	√
VI	8	Gravitation	9	8			√	√	
VII	9	Mechanical properties of solids	5	4	√√	√			
	10	Mechanical properties of fluids	5	4	√		√		
	11	Thermal properties of matter	10	9		√	√	√	
VIII	12	Thermodynamics	8	6	√				√
IX	13	Kinetic theory	5	4	√		√		
X	14	Oscillations	8	7		√		√	
	15	Waves	10	10	√		√		√
TOTAL			**120**	**105**	**10**	**16**	**24**	**30**	**25**

MODEL QUESTION PAPER – 1

I P.U.C. PHYSICS (33)

Time: 3 hours 15 min. **Max. Marks: 70**

General instructions:

a) All parts are compulsory.

b) Answers without relevant diagram/ figure/circuit wherever necessary will not carry any marks.

c) Direct answers to the Numerical problems without detailed solutions will not carry any marks.

PART – A

I. Answer the following 10 x 1 = 1

1. Write the S I t of momentum.
2. Is scalar multiplied by a vector, a vector or a scalar?
3. Write an expression for position vector of centre mass of system of two particles lie on x - axis
4. Mention the expression for work done by a force in vector form.
5. What is the height of the geostationary orbit form the surface of the earth?.
6. Among rubber and steel which one has more elasticity?
7. What is ideal gas?
8. Define angle of contact.
9. State the first law of thermodynamics.
10. Mention any one applications of beats.

PART – B

II. Answer any FIVE of the following questions. **5×2=10**

11. Mention any two basic forces in nature.
12. Mention two uses of dimensional analysis
13. Distinguish between distance (path length) and displacement.
14. What is centripetal acceleration? Give the expression for it.
15. Mention any two methods of reducing friction
16. Determine the volume contraction of the solid copper cube, 10cm on its edge, when subjected to hydraulic pressure of 7.0 x10^6Pa.(Given bulk modulus of copper =140x10 Nm^{-2}).
17. What is specific heat capacity of a substance? Write the relation between specific heat capacities of gases.
18. On an average the human heart is found to beat 75 times in minute. Calculate its frequency.

PART – C

III. Answer any FIVE of the following questions. **5×3=15**

19. State and explain Law of triangle of vectors. When will be the resultant of two given vectors is maximum?

20. State Newton's second law of motion and hence derive F = ma .

21. Prove work- energy theorem for a constant force
22. Derive an expressions orbital speed of the earth's satellite.
23. state and explain Bernoulli's theorem.
24. Write any three properties of heat radiation.
25. State the law of equipartition of energy. Write an expression for the energy associated with diatomic molecule.
26. Discus the modes of vibrations in closed path.

PART – D

IV. Answer any TWO of the following questions. 2×5=10

27. Derive $x = v_0 t + \frac{1}{2} a t^2$ by graphical method.

28. State and prove the law of conservation of linear momentum in case of collision of two bodies.

29. Derive the relation between torque and angular momentum of a particle.

V. Answer any TWO of the following questions. 2×5=10

30. State and explain Kepler's laws of planetary motion.

31. Write a note on kelvin scale of temperature.

32. Derive an expression for period of simple pendulum.

VI. Answer any THREE of the following questions. 3×5=15

33. The ceiling of a long hall is 25 m high. What is the maximum horizontal distance that a ball thrown with a speed of 40 m s^{-1} can go without hitting the ceiling of the hall?

34. A pump on the ground floor of a building can pump up water to fill a tank of volume 30 m^3 in 15 min. If the tank is 40 m above the ground, and the efficiency of the pump is 30%, how much electric power is consumed by the pump?

35. A 5 kg wheel is given an acceleration of 10 rad/sec^2 by an applied torque of 2 N-m. Calculate its (a) moment of inertia and (b) radius of gyration.

36. A steam engine delivers 5.4×10^8J. of work per minute and serves 3.6×10^9J of heat per minute from its boiler. what is the efficiency of the engine? How much heat is wasted per minute.

37. A train standing at the outer signal of railway station blows a whistle of frequency 400Hz in still air. i) what is the frequency of the whistle for a platform observer when the train (a) approaches the platform with a speed of 10m/s. b) recedes from the platform with a speed of 10m/s? ii) what is the speed of the sound in each case. the speed of sound in still can be taken as 340m/s.

SCHEME OF EVALUATION FOR I PU PHYSICS MODEL QUESTION PAPER – 1

PART – A

I. Answer the following 10 x 1 = 10

1. Write the S I t of momentum.

   kg ms^{-1}. 1

2. Is scalar multiplied by a vector, a vector or a scalar?

   It is a vector 1

3. Write an expression for position vetor of centre mass of system of two particles on x axis.

   $X = \frac{m_1x_1+m_2x_2}{m_1+m_2}$ 1

4. Mention the expression for work done by a forcce in vector form.

   W=$\vec{F}.\vec{S}$ 1

5. State Hook's law.

   With in elastic limit stress is directly proportional to strain 1

6. Amomg rubber and steel which one has more elasticity?

   Steel 1

7. What is an ideal gas?

   A gas which obeys both boyle's law and charle's law is called ideal gas 1

8. Define angle of contact.

   It is an angle between the tangent drawn to the surface of liquid at the point of contact with the surface of contact with in the liquid.

   1

9. State the first law of thermodynamics.

   The law stats that heat energy given to the system is equal to sum of the increase in internal energy and work done by the systerm . 1

10. Mention any one application of beats.

Beats are used to tune the musical instruments.

They are used to detect the poisonous gases in mines. or any use

1

PART – B

II. Answer any FIVE of the following questions. 5×2=10

11. Mention any two basic forces in nature.

Gravitational force one each

Electral force

Strong nuclear force

Weak nuclear force (any two)

12. Mention two uses of dimensional analysis

Any two of the following one each

Check the correctness of the equation

To convert unit of physical quantity in one system into other system of units

To derive the relation between physical quintiles

13. Distinguish between distance (path length) and displacement. one each

Distnce or path length	displacement
It is the length of the path along which the body moved	It is the shortest distance between initial final positions.
It a scalar	It is a vector
It cannot be negative	It can be negative,positive or zero

14. What is centripetal acceleration? Give the expression for it.

The acceleration of a body towards the centre of a circular path along which the body moves 1

$a = v^2/r = r^2\omega$ 1

15. Mention any two methods of reducing friction

Any two one each

Using lubricants, using ball bearings, by smoothening the surface etc.

16. Determine the volume contraction of the solid copper cube, 10cm on its edge, when subjected to hydraulic pressure of 7.0×10^6Pa.(Given bulk modulus of copper $=140 Nm^{-2}$).

$B = \frac{P}{\frac{\Delta V}{V}} =$

17. What is specific heat capacity of a substance? writethe relation between specific heat capacities of gases.

It is the quantity of heat required to raise temperature of one kg of sbstance through one degree celcius. 1

$C_P - C_V = R$ 1

18. On an average the human heart is found to beat 75 times in minute. calculate its frequency.

f = number of oscillations /time 1

f= 1.25Hz. 1

PART – C

III. Answer any FIVE of the following questions. 5×3=15

19 . State and explain Law of triangle of vectors. when will be the resultant of two given vectors is maximum?

Statement 1

Explanation/fig 1

$\theta = 0$ 1

20. State Newton's second law of motion and hence derive F = ma .

Statement 1

Explanation 1
Arriving at f = ma 1

21. Prove work- energy theorem for a constant force.

$$v^2 = u^2 + 2\,a\,x$$ 1

$$\frac{1}{2}m(v^2 - u^2) = \frac{m}{2}2\,a\,x$$

$$\frac{1}{2}mv^2 - \frac{1}{2}mu^2 = m\,a\,x$$ 1

Final KE – Initial KE = F x

Change in kinetic energy = work done 1

22. Derive an expressions orbital speed of the earth's satellite.

Figure 1

Centripetal force = gravitational force.

$$\frac{m\,v_o^{\,2}}{r} = \frac{G\,M\,m}{r^2}$$ 1

$$v_o = \sqrt{\frac{GM}{r}}$$

$$\boxed{v_o = \sqrt{\frac{GM}{R+h}}}$$ 1

23. State and expalin Bernoulies theorem.

Statement. 1

Explanation. Consider an incompressible liquid of density ρ be flowing through a pipe at a height **h** from the reference level as shown in the figure. Let v be the velocity.

According to Bernoulli's theorem,

$\frac{1}{2} v^2 + g\,h + p/\rho$ = constant. 2

24. Wite any three properties of heat radiation.

Any properties

1each

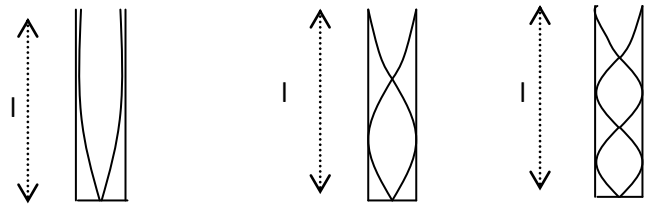
25. State the law of equipartition of energy. write an expression for the energy associated with diatomic molecule.

Statement 1

U= (5/2) kT 1

Explanation of symbols. 1

25. Discus the modes of vibrations in closed path.



1

First (Fundamental) mode of vibration

$$f_1 = \frac{v}{4\ l} \text{--------->(1)}$$

For second mode of vibration: $v = f_2\lambda_2$

$$f_2 = \frac{v}{\lambda_2}$$

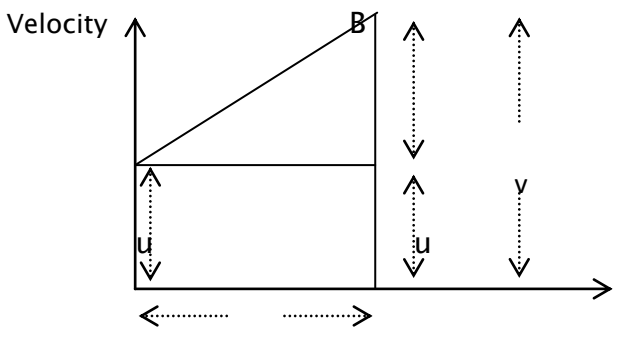
$$f_2 = 3f_1 \text{--------->(2)}$$ 1

From Equations(1),and(2) it is found that, $f_1:f_2:f_3$: = …. = 1:3:5: …… 1

PART – D

IV. Answer any TWO of the following questions. **2×5=10**

27.Derive $x = v_0t + \frac{1}{2}at^2$ by graphical method.



O t D Time 1

In the above v-t graph,

AO= DC = u is the initial velocity of the body ,

BD = v is the final velocity of the body ,

BC= (v-u) is the change in velocity in time interval t .

Let ‘a’ be the uniform acceleration and ‘x’ be the displacement of the body.

We have, Displacement = Area under the v-t curve AB 1

x = Area of the rectangle OACD + Area of the triangle ACB

$x = [OA \times OD] + \frac{1}{2}[AC \times BC]$ 1

$x = [t \times u] + \frac{1}{2}[t \times (v-u)]$

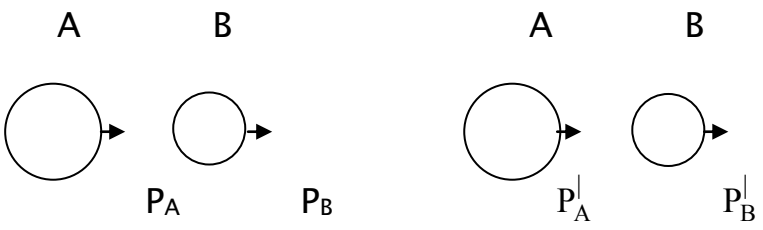
$x = ut + \frac{1}{2}[t(at)]$ $\because v - u = at$ 1

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

28. State and prove the law of conservation of linear momentum in case of collision of two bodies.

statement 1

Proof of the law.



Before collision After collision

Impulse = Change in momentum. 1

==> Force × time = Final momentum – initial momentum.

Impulse experienced by the body A is given by,

$$F_{AB}\,dt = P_A' - P_A \Longrightarrow F_{AB} = \frac{P_A' - P_A}{dt} \text{---->(1)}$$

1

Impulse experienced by the body B is given by,

$$F_{BA}\,dt = P_B' - P_B \Longrightarrow F_{BA} = \frac{P_B' - P_B}{dt} \text{---->(2)}$$

From Newton' third law of motion,

$$F_{AB} = -F_{BA}$$ 1

$\therefore$ From(1)&(2), we get $\frac{P_A' - P_A}{dt} = -\frac{P_B' - P_B}{dt}$

On rearranging, we get,

$$P_A + P_B = P_A' + P_B'$$ 1

29. Derive the relation between torque and angular momentum of a particle.

$$\vec{L} = (\vec{p} \times \vec{r}) \text{ ---->(1)}$$ 1

$$\frac{d\vec{L}}{dt} = \frac{d}{dt}(\vec{p} \times \vec{r})$$

$$\frac{d\vec{L}}{dt} = \vec{p}\frac{dr}{dt} + \vec{r}\frac{dp}{dt} \text{----->(2)}$$

But $\frac{dr}{dt} = v$, $\frac{dp}{dt} = F = \text{force}$

$$(2)\Longrightarrow \quad \frac{d\vec{L}}{dt} = \vec{p} \times \vec{v} + \vec{r} \times \vec{F} \qquad 1$$

$$\frac{d\vec{L}}{dt} = m\ \vec{v} \times \vec{v} + \vec{r} \times \vec{F} \qquad \because\ \vec{p} = m\vec{v}$$

$$\therefore \frac{d\vec{L}}{dt} = \vec{r} \times \vec{F} \qquad 1$$

But $\vec{r} \times \vec{F} = \vec{\tau}$ = cross produt of $\vec{r}$ & $\vec{F}$

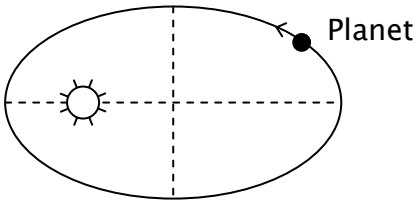
$$\therefore \vec{\tau} = \frac{d\vec{L}}{dt} \qquad 1$$

Answer any TWO of the following questions. $2\times5=10$

30. State and explain Kepler's laws of planetary motion.

All planets move around the sun in elliptical orbits with the sun at one of the foci. 1

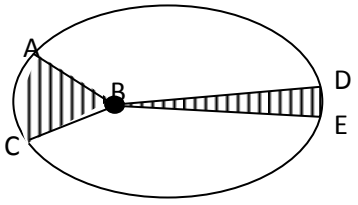
Explanation



Second law (law of areas).

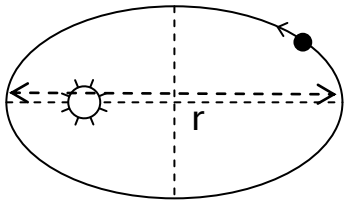
An imaginary line that joins the planet and the sun sweeps equal areas in equal intervals of time. 1

Explanation



In the above figure, Area of ABC = Area of DBE 1

Square of the period of revolution of the planet around the sun is directly proportional to the cube of the length of the semi major axis of ellipse. 1



From law of period, $T^2 \propto r^3$ 1

31. Write a note on kelvin scale of temperature

From Charles law $V = V_0 (1 + \alpha t)$ --------->(1) 1

If $t = -273^0C$, then (1)===>$V = V_0 \left(1-\frac{273}{273}\right)$

$V = 0$ 1

Volume of gas becomes zero at -273^0C theoretically which is shown in the above fig. But practically all known gases become liquids before attaining this temperature (-273^0C). From Charles law this is the lowest possible temperature.

1

Lord Kelvin made a scale by taking -273^0C as lowest temperature. It is called absolute scale of temperature. The lowest temperature is called absolute zero ($0K=-273^0C$). The temperature on the Kelvin scale is called absolute temperate. The width of each degree on the Kelvin scale is equal to the width of each degree on Celsius scale. The relation between Celsius scale temperature (t) & Kelvin scale temperature (T) is given by $T = (t + 273)\ K$ 2

32. Derive an expression for period of simple pendulum.

Figure 1

Torque;

$\tau = -L\ mg\sin\theta$

For small amplitude

$\tau = L\ mg\theta$ 1

But $\tau = I\alpha$

$= - I\omega^2\theta$ 1

$L\ mg = I\omega^2$

For a bob of mass m, the moment of inertia is given by

$I = mL^2$ 1

$\rightarrow\ \omega^2 = g/L$

$T = 2\pi\sqrt{\frac{L}{g}}$ 1

V. Answer any THREE of the following questions. $3\times5=15$

33. The ceiling of a long hall is 25 m high. What is the maximum horizontal distance that a ball thrown with a speed of 40 m s^{-1} can go without hitting the ceiling of the hall?

$$h = \frac{u^2 \sin^2\theta}{2g}$$ 1

$$25 = \frac{(40)^2 \sin^2\theta}{2\times9.8}$$

$\therefore\theta = \sin^{-1}(0.5534) = 33.60°$ 1

Horizontal range, $R = \frac{u^2 \sin2\theta}{g}$ 1

$$25 = \frac{(40)^2 \sin^2 2\times33.6}{9.8}$$ 1

$= 150.33m$

1

34. A pump on the ground floor of a building can pump up water to fill a tank of volume 30 m^3 in 15 min. If the tank is 40 m above the ground, and the efficiency of the pump is 30%, how much electric power is consumed by the pump?

1

$$P_0 = \frac{\text{Work done}}{\text{Time}} = \frac{mgh}{t}$$

$$= \frac{30 \times 10^3 \times 9.8 \times 40}{900} = 13.067 \times 10^3 \text{ W}$$

1

For input power P_i, efficiency η is given by the relation:

$$\eta = \frac{P_0}{P_i} = 30\%$$

$$P_i = \frac{13.067}{30} \times 100 \times 10^3$$

$$= 0.436 \times 10^5 \text{ W}$$
$$= 43.6 \text{ kW}$$

1

35. A 5 kg wheel is given an acceleration of 10 rad/sec^2 by an applied torque of 2 N-m. Calculate its (a) moment of inertia and (b) radius of gyration.

$I=\tau/\alpha$ 1
$I = 2/10$ 1
$I = 0.2kgm^2$. 1
And
$I = MK^2$. 1
$K=0.2m$ 1

36. A steam engine delivers $5.4x10^8$J. of work per minute and serves $3.6x10^9$J of heat per minute from its boiler. what is the efficiency of the engine? How much heat is wasted per minute.

$\eta = w/q_1$ 1

$= 5.4x10^8/3.6x10^9$. 1

$= 15\%$ 1

$Q_2 = Q_1 - W$ 1

$= 36x10^8 - 5.4x10^8$.

$= 30.6x10^8J$ 1

37. A train standing at the outer signal of railway station blows a whistle of frequency 400Hz in still air. i) what is the frequency of the whistle for a platform observer when the train (a) aproaches the platform with a speed of 10m/s. b) receeds from the platform with a speed of 10m/s? ii) what is the speed of the sound in each case. the speed of sound in still can be taken as 340m/s.

$f' = f\, v/(v - v_s)$

1

$=400(340-0)/340-10)$ 1

$= 412Hz.$ 1

$f'' = f\, v/(v + v_s)$ 1

$f''=400(340)/(340+10)$

$= 389Hz.$ 1