FIITJEE

HYDERABAD CENTRES

IMPORTANT QUESTIONS

FOR

INTERMEDIATE PUBLIC EXAMINATIONS

IN

FIRST YEAR

PHYSICS

2020 – 2021

TELANGANA STATE BOARD OF INTERMEDIATE EDUCATION, HYDERABAD

ACADEMIC YEAR 2020-2021

70% CONTENT IN VIEW OF COVID-19 PANDEMIC

INTERMEDIATE 1st YEAR PHYSICS SYLLABUS

CHAPTER – I: PHYSICAL WORLD

1.1. What is Physics?

1.4 Fundamental forces in nature

CHAPTER –II: UNITS AND MEASUREMENTS

2.1 Introduction

2.2 The International system of units

2.3 Measurement of length

2.4 Measurement of mass

2.5 Measurement of time

2.6 Accuracy, precision of instruments and errors in measurement

2.7 Significant figures

2.8 Dimensions of physical quantities

2.9 Dimensional formulae and dimensional equations

2.10 Dimensional analysis and its applications

Chapter-III: MOTION IN A STRAIGHT LINE

3.1 Introduction

3.2 Position, path length and displacement

3.3 Average velocity and average speed

3.4 Instantaneous velocity and speed

3.5 Acceleration

3.6 Kinematic equations for uniformly accelerated motion

3.7 Relative Velocity

CHAPTER –IV : MOTION IN A PLANE

4.1 Introduction

4.2 Scalars and vectors

4.3 Multiplication of vectors by real members

4.4 Addition and subtraction of vectors graphical method

4.5 Resolution of vectors

4.6 Vector addition Analytical method

4.7 Motion in a plane

4.8 Motion in a plane with constant acceleration

4.9 Relative velocity in two dimensions

4.10 Projectile motion

4.11 Uniform circular motion

CHAPTER-V: LAWS OF MOTION

5.1 Introduction

5.7 Conservation of momentum

5.8 Equilibrium of a particle

5.9 Common forces in mechanics

5.10 Circular motion

5.11 Solving problems in mechanics

CHAPTER – VI: WORK, ENERGY AND POWER

6.1 Introduction
6.2 Notions of work and kinetic energy: The work-energy theorem
6.3 Work
6.4 Kinetic Energy
6.5 Work done by a variable force
6.6 The work-energy theorem for a variable force.
6.7 The concept of potential energy
6.8 The conservation of mechanical energy
6.9 The potential energy of a spring
6.10 Various forms of energy: the law of conservation of energy
6.11 Power
6.12 Collisions

CHAPTER-VII: SYSTEM OF PARTICLES AND ROTATIONAL MOTION

7.1 Introduction
7.2 Centre of mass. Centre of gravity
7.3 Motion of Centre of mass
7.4 Linear momentum of a system of particles
7.5 Vector product of two vectors
7.6 Angular velocity and its relation with linear velocity
7.7 Torque and angular momentum
7.8 Equilibrium of a rigid body
7.9 Moment of inertia
7.10 Dynamics of rotational motion about a fixed axis.
7.11 Angular momentum in case of rotations about a fixed axis.
7.12 Rolling motion

Chapter VIII: OSCILLATIONS

8.1 Introduction
8.2 Periodic and oscillatory motions
8.3 Simple Harmonic motions
8.4 Simple Harmonic motion and uniform circular motion
8.5 Velocity and acceleration in simple harmonic motion
8.6 Force law for simple harmonic motion
8.7 Energy in simple harmonic motion
8.8 Some systems executing simple harmonic motion
8.9 Damped simple harmonic motion
8.10 Forced oscillations and resonance

CHAPTER –IX: GRAVITATION

9.1 Introduction
9.3 Universal law of gravitation
9.6 Acceleration due to gravity below and above the surface of earth
9.7 Gravitational Potential energy
9.8 Escape Speed
9.9 Earth Satellite
9.10 Energy of an orbiting satellite
9.11 Geo Stationary and Polar Satellites
9.12 Weightlessness

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ACADEMIC YEAR 2020-2021

70% CONTENT IN VIEW OF COVID-19 PANDEMIC

INTERMEDIATE 1st YEAR PHYSICS PRACTICALS SYLLABUS

1. Vernier caliper
2. Screw gauge
3. Simple pendulum
4. Parallelogram law of forces
5. Force constant of a spring
6. Boyle's law
7. Specific heat of a solid

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ACADEMIC YEAR 2020-2021

30% DELETED CONTENT IN VIEW OF COVID-19 PANDEMIC

INTERMEDIATE 1st YEAR PHYSICS SYLLABUS

CHAPTER – I: PHYSICAL WORLD

1.2 Scope and Excitement of Physics.

1.3 Physics Technology and Society

1.5 Nature of Physical Laws

CHAPTER –II: UNITS AND MEASUREMENTS

No Deletions

Chapter-III: MOTION IN A STRAIGHT LINE

No Deletions

CHAPTER –IV: MOTION IN A PLANE

No Deletions

CHAPTER-V: LAWS OF MOTION

5.2 Aristotle's fallacy

5.3 The law of inertia

5.4 Newton's first law of motion

5.5 Newton's second law of motion

5.6 Newton's third law of motion

(These topics are deleted, however they must be recapitulated as a pre-requisite to deal with the remaining topics of the chapter.)

CHAPTER – VI: WORK, ENERGY AND POWER

No Deletions

CHAPTER-VII: SYSTEM OF PARTICLES AND ROTATIONAL MOTION

7.10 Theorems of perpendicular and parallel axes.

Chapter VIII: OSCILLATIONS

No Deletions

CHAPTER –IX: GRAVITATION

9.2 Kepler's laws

9.4 The Gravitational Constant (despite the topic is deleted, the value of G should be mentioned to the student)

9.5 Acceleration due to gravity of earth

CHAPTER –X: MECHANICAL PROPERTIES OF SOLIDS

10.6.2 Determination of Young's Modulus of the material of a wire.

10.6.3 Shear modulus

10.6.5 Poisson's ratio

10.6.6 Elastic potential energy in a stretched wire

10. 7 Applications of elastic behavior of materials

CHAPTER – XI: MECHANICAL PROPERTIES OF FLUIDS

No Deletions

CHAPTER – XII: THERMAL PROPERTIES OF MATTER

12.9 Heat Transfer

12.9.1 Conduction

12.9.2 Convection

12.9.3 Radiation

(These topics are deleted, however they must be recapitulated as a pre-requisite to deal with the remaining topics of the chapter.)

CHAPTER – XIII: THERMODYNAMICS

13.9 Heat engines

13.10 Refrigerator and heat pumps

13.13 Carnot engine

CHAPTER – XIV: KINETIC THEORY

No Deletions

Deleted Experiments of First Year Practicals

1. Physical balance
2. Surface tension
3. Apparent expansion of liquids

PAPER PATTERN

Question Type	No. of Question given	No. of questions to be answered	Marks of each question	Total Marks
VSAQ	**10**	**10**	**2**	**20**
SAQ	**12**	**6**	**4**	**24**
LAQ	**4**	**2**	**8**	**16**
			GRAND TOTAL	**60**

TS Inter 1st year Physics Blue Print 2021 Junior Physics

S.No	CHAPTER	2M	4M	8M	Total
1	Physical World	1	–	–	2
2	Units & Measurements	1	–	–	2
3	Motion in a Straight Line	–	1	–	4
4	Motion in a plane	1	1	–	6
5	Laws of Motion	1	1	–	6
6	Work, Energy & Power	–	–	1	8
7	System of Particles	2	1	–	8
8	Oscillations	–	–	1	8
9	Gravitation	–	1	–	4
10	Mechanical Properties of Solids	–	1	–	4
11	Mechanical Properties of Fluids	2	–	–	4
12	Thermal Properties of Matter	2	1	–	8
13	Thermodynamics	(1)	(1)	1	6 or 8
14	Kinetic Theory of Gases	(2)	1	–	4
	Total Number of Questions	**10**	**8**	**3**	**76**

TSBIE - MODEL PAPER
PHYSICS - I

Time: 3 Hours ***Max.Marks: 60***

SECTION - A

10 x 2 = 20

Note: (i) Answer ALL Questions

(ii) Each Question carries TWO marks

(iii) ALL are very short answer type questions.

1. What are the fundamental forces in nature?
2. How can systematic errors be minimised or eliminated ?
3. $A = \vec{i} + \vec{j}$. What is the angle between the vector and x-axis?
4. Why does the car with a flattened tyre stop sooner than the one with inflated tyres '?
5. Why are spokes provided in a bicycle wheel?
6. By spinning eggs on a table top, how will you distinguish a hard boiled egg from a raw egg?
7. Why are drops and bubbles spherical?
8. "Terminal velocity is more if surface area of the body is more". Give reasons in support of your answer.
9. When does a real gas behave like an ideal gas?
10. Pressure of an ideal gas in container is independent of shape of the container– explain

SECTION - B

6 x 4 = 24

Note: (i) Answer any SIX Questions

(ii) Each Question carries FOUR marks

(iii) ALL are short answer type questions.

11. A particle moves in a staright line with uniform acceleration. Its velocity at time t=0 is v_1 and at time t=t is v_2. The average velocity of the particle in this time interval is $(v_1+v_2)/2$. Is this correct? Substantiate your answer.

12. A ball is dropped from the roof of a tall building and simultaneously another ball is thrown horizontally with some velocity from the same roof. Which ball lands first ? Explain your answer.

13. If $\left|\vec{a}+\vec{b}\right|=\left|\vec{a}-\vec{b}\right|$ prove that the angle between $\vec{a}$ and $\vec{b}$ is 90°.

14. Show that the trajectory of an object thrown at certain angle with the horizontal is a parabola.

15. Explain advantages and disadvantages of friction.

16. Distinguish between centre of mass and centre of gravity.

17. What is escape velocity? Obtain an expression for it.

18. What is a geostationary satellite? State its uses.

19. Explain why steel is preferred to copper, brass, aluminium in heavy-duty machines and in structural designs.

20. Pendulum clocks generally go fast in winter and slow in summer. Why?

21. Obtain an expression for the work done by an ideal gas during isothermal change.

22. Explain the following processes

i) Cyclic process with example

ii) Non cyclic process with example

SECTION - C

2 x 8 = 16

Note: (i) Answer any TWO Questions

(ii) Each Question carries EIGHT marks

(iii) ALL are Long answer type questions.

23. Develop the notions of work and kinetic energy and show that it leads to work-energy theorem.

A machine gun fires 360 bullets per minute and each bullet travels with a velocity of 600 ms^{-1}. If the mass of each bullet is 5 gm, find the power of the machine gun?

24. State and prove law of conservation of energy in case of a freely falling body.

A pump is required to lift 600 kg of water per minute from a well 25 m deep and to eject it with a speed of 50 ms^{-1}. Calculate the power required to perform the above task?

25. Show that the motion of a simple pendulum is simple harmonic and hence derive an equation for its time period. What is seconds pendulum?

26. State and explain Newton's law of cooling. State the conditions under which Newton's law of cooling is applicable. A body cools down from 60°C to 50°C in 5 minutes and to 40°C in another 8 minutes. Find the temperature of the surroundings.

VERY SHORT ANSWER QUESTIONS

PHYSICAL WORLD

1. What is the discovery of C.V. Raman?
2. Which of the following has symmetry.

   a) acceleration due to gravity b) law of gravity
3. What is the contribution of S. Chandra Sekhar to physics?
4. What are the fundamental forces in nature?

UNITS AND MEASUREMENTS

1. Distinguish between accuracy and precision.
2. How can systematic errors can be minimised or eliminated.
3. What are significant figures and what do they represent when reporting the result of a measurement?
4. Distinguish between fundamental and derived units.
5. Express unified atomic mass unit in kg.
6. What are the different types of errors that can occur in a measurement?
7. What is dimensional analysis?
8. The velocity of a body is given by $v = At^2 + Bt + C$. If v and t are expressed in SI, what are the units of A, B, C?
9. State the number of significant figures in the following:

   (a) 6729 (b) 0.024 (C) 0.08240 (d) 6.032 (d) 4.57×10^8
10. The measured mass and volume of a body are 2.42 g and $4.7 cm^3$ respectively with possible errors 0.01 g and $0.1 cm^3$. Find the maximum error in density.
11. The error in measurement of radius of a sphere is 1%. What is the error in the measurement of volume?
12. The percentage error in the mass and speed are 2% and 3% respectively. What is the maximum error in kinetic energy calculated using these quantities?

MOTION IN A STRAIGHT LINE

1. The states of rest and motion are relative. Explain.
2. How is average velocity different from instantaneous velocity?
3. Give an example where the velocity of an object is zero but its acceleration is not zero.
4. If the trajectory of a body is parabolic in one frame can it be parabolic in another frame that moves with a constant velocity with respect to the first frame? If not what can it be?
5. A vehicle travels half the distance L with speed v_1 and the other half with speed v_2. What is the average speed?

MOTION IN A PLANE

1. $\overline{A} = \hat{i} + \hat{j}$, what is the angle between the vector and X-axis?
2. When two right angled vectors of magnitudes 7 and 25 units combine find the magnitude of their resultant.
3. Can a vector of magnitude zero, have non-zero components?
4. What is the acceleration of a projectile at the top of its trajectory?

5. Explain the terms the average velocity and instantaneous velocity when are they equal?
6. The vertical component of a vector is equal to its horizontal component. What is the angle made by the vector with x-axis?
7. Two forces of magnitudes 3 units and 5 units act at 60° with each other. What is the magnitude of their resultant?
8. A vector v makes an angle e with the horizontal. The vector is rotated through an angle e. Does this rotation change the vector v.

LAWS OF MOTION

1. When a bullet is fired from a gun, the gun gives a kick in the backward direction. Explain?
2. If a bomb at rest explodes into two pieces, the pieces must travel in opposite directions. Explain?
3. Can coefficient of friction be greater than one?
4. Why does the car with a flattened tyre stop sooner than the one with inflated tyres?
5. A horse has to pull harder during the start of the motion than later. Explain?
6. What happens to the coefficient of friction if the weight of the body is doubled?
7. Why are shock absorbers used in motor cycles and cars?
8. Why does a heavy rifle not recoil as strongly as a light rifle using the same cartridges?
9. Define force. What are the basic forces in nature?

WORK, ENERGY AND POWER

1. Define work, power and energy. State their SI units.
2. State the relation between kinetic energy and momentum of a body.
3. Which physical quantity remains constant.
   i) in an elastic collision ii) in an inelastic collision
4. State the conditions under which a force does no work.
5. State the sign of work done by a force in the following.
6. (a) work done by a man in lifting a bucket out of a well by means of rope tied to the bucket.
   (b) work done by gravitational force in the above case.
7. State the sign of the work done by a force in the following.
   (a) work done by friction on a body sliding down an inclined plane.
   (b) work done by gravitational force in the above case.
8. State the sign of work done by a force in the following.
9. (a) work done by an applied force on a body moving on a rough horizontal plane with uniform velocity.
   (b) work done by the resistive force of air on a vibrating pendulum in bringing it to rest.
10. A body freely falling from a certain height ‘h’, after striking a smooth floor rebounds and rises to a height h/2. What is the coefficient of restitution between the floor and the body?

SYSTEMS OF PARTICLES AND ROTATIONAL MOTION

1. Is it necessary that a mass should be present at the centre of mass of any system?
2. Why are spokes provided in a bicycle wheel?
3. We cannot open or close a door by applying force at the hinges. Why?
4. By spinning eggs on a table top. How will you distinguish a hard boiled egg from a raw egg?
5. Why should a helicopter necessarily have two propellers?

6. Why is easier to balance a bicycle in motion?
7. Distinguish between centre of mass and centre of gravity.
8. Explain about the centre of mass of earth-moon system and its rotation around the sun.
9. If the polar ice caps of the earth were to melt, what would the effect of the length of the day be?

OSCILLATIONS

1. Give two examples of periodic motion which are not oscillatory.
2. A girl is swinging in a swing. What is the effect on the frequency of oscillations if she stands.
3. Will a pendulum clock gain or lose time when taken to the top of a mountain.
4. What happens to the energy of a simple harmonic oscillator if its amplitude is doubled?
5. Can a simple pendulum be used in an artificial satellite?
6. The displacement in S.H.M. is given by $y = a\sin(20t + 4)$. What is the displacement when it is increased by $2\pi/\omega$?
7. The bob of a simple pendulum is a hollow sphere filled with water. How will the period of oscillation change, if the water begins to drain out of the hollow sphere?
8. A pendulum clock gives correct time at the equator. Will it gain or lose time, if it is taken to the poles? If so, why?
9. What happens to the time period of a simple pendulum kept inside a lift, when the lift

   (i) moves up with acceleration 'a'? (ii) moves down with acceleration 'a'?
10. What are physical quantities having maximum value at the mean position in SHM?
11. What are physical quantities having maximum value at the extreme position in SHM?

GRAVITATION

1. State the unit and dimension of the universal gravitational constant (G).
2. 'Hydrogen is abundant around the sun but not around earth'. Explain.
3. What is the time period of revolution of a geostationary satellite? Does it rotate from west to east or from east to west?
4. As we go from one planet to another, how will

   a) the mass and b) the weight of body change
5. Keeping the length of a simple pendulum constant, will the time period be same on all planets? Support your answer with reason.
6. What are polar satellites?
7. State the vector form of Newtons law of gravitation.
8. Give the equation for the value of g at a depth 'd' from the surface of Earth. What is the value of 'g' at the centre of Earth?
9. What are the factors that make 'g' the least at the equator and maximum at the poles?
10. What is the time period of revolution of geostationary satellite? Does it rotate from West to East or from East to West?

MECHANICAL PROPERTIES OF SOLIDS

1. State Hooke's law of elasticity.
2. State the units and dimensions of stress.
3. State the units and dimensions of modulus of elasticity.
4. State the examples of nearly perfect elastic and plastic bodies.

5. Explain why the maximum height of a mountain on earth is approximately 10 km?
6. A copper wire of 1 mm diameter is stretched by applying a force of 10 N. Find the stress in the wire.
7. A tungsten wire of length 20 cm is stretched by 0.1 cm. Find the strain on the wire.
8. If an iron wire is stretched by 1%, What is the strain on the wire?
9. A steel wire of length 20 cm is stretched to increase its length by 0.2 cm. Find the lateral strain in the wire if the Poisson's ratio for steel is 0.19.

MECHANICALPROPERTIES OF FLUIDS

1. Define viscosity. What are its units and dimensions?
2. What is magnus effect?
3. Why are drops and bubbles spherical?
4. Give an expression for the excess pressure in a liquid drop?
5. Define average pressure. Mention its units and dimensional formula. Is it a scalar or a vector?
6. What is the principle behind the carburettor of an automobile.
7. Give the expression for the excess pressure in an air bubble inside the liquid.
8. Give the expression for the soap bubble in air.
9. What are water proofing agents and water wetting agents? What do they do?
10. What is angle of contact? What are its values for pure water and mercury?
11. If the diameter of a soap bubble is 10 mm and its surface tension is 0.04 N/m, find the excess pressure inside the bubble.
12. The density of the atmosphere at sea level is $1.29 kg/m^2$. Assuming that it does not change with altitude. Then how high would the atmosphere extend?
13. Calculate the work done in blowing a soap bubble of diameter 0.6 cm against the surface tension force. (Surface tension of soap solution = $2.5 \times 10^{-2} Nm^{-1}$).

THERMAL PROPERTIES OF MATTER

14. Can a substance contract on heating? Give an example.
15. Why gaps are left between rails on a railway track?
16. Why do liquids have no linear and areal expansions?
17. What is specific gas constant? Is it same for all gases?
18. Why utensils are coated black? Why the bottom of the utensils are made of copper?
19. State Wien's displacement law?
20. Ventillators are provided in rooms just below the roof. Why?
21. Does a body radiate heat at OK? Does it radiate heat at $0^{\circ}C$?
22. What is greenhouse effect? Explain global warming.
23. Define absorptive power of a body. What is the absorptive power of a perfect black body?
24. The roof of buildings are often painted white during summer. Why?
25. Two identical rectangular strips one of copper and the other of steel are riveted together to form a compound bar. What will happen on heating?
26. Pendulum clocks generally go fast during winter and slow in summer. Why?
27. Distinguish between heat and temperature.
28. What are the lower and upper fixing points in Celsius and Fahrenheit scales?

29. Do the values of coefficients of expansion differ, when the temperatures are measured on Centigrade scale or on Fahrenheit scale?
30. What is latent heat of fusion?
31. What is latent heat of vapourisation?
32. What are the units and dimensions of specific gas constant?
33. What is thermal resistance of a conductor? On what factors does it depend?
34. State the units and dimensions of coefficient of convection?
35. Define emissive power and emissivity.

THERMODYNAMICS

1. Define calorie. What is the relation between calorie and mechanical equivalent of heat?
2. What thermodynamic variables can be defined by

   a) zeroth law b) first law
3. Define state variables and equations of state.
4. In summer, when the valve of a bicycle tube is opened. The escaping air appears cold. Why?
5. Can a room be cooled by leaving the door of an electric refrigerator open?
6. Which of the two will increase the pressure more, an adiabatic or an isothermal process, in reducing the volume to 50%?
7. A thermos flask containing a liquid is shaken vigorously. What happens to its temperature?
8. How much will be the internal energy change in

   i) isothermal process ii) adiabatic process
9. The coolent in a chemical or a nuclear plant should have high specific heat. Why?
10. Define Thermal equilibrium. How does it lead to Zeroth law of Thermodynamics?
11. Define specific heat capacity of the substance. On factors does it depend?
12. Define molar specific heat capacity.
13. For a solid, what is the total energy of an oscillator?
14. Why does the brake drum of an automobile get heated up while moving down at constant speed?
15. A sound wave is sent into a gas pipe. Does its internal energy change?
16. What are the values of specific heat capacity in

    (a) adiabatic system (b) isothermal system

KINETIC THEORY

1. Define mean free path.
2. When does a real gas behave like an ideal gas?
3. State Dalton's law of partial pressures.
4. Name two prominent phenomena which provide conclusive evidence of molecular motion.
5. State Boyle's law and Charles Law.
6. Explain the concept of degrees of freedom for molecules of a gas.
7. What is the expression between pressure and kinetic energy of a gas molecule?
8. When pressure increases by 2%. What is the percentage decreases in the volume of a gas. Assuming Boyle's law is obeyed.

SHORT ANSWER QUESTIONS

MOTION IN A STRAIGHT LINE

1. Can the equations of kinematics be used when the acceleration varies with time? If not what from would these equations take?
2. S.T. the maximum height reached by a projectile launched at an angle of 45° is one quarter of its range.
3. Derive the equation $x = v_0 t + \frac{1}{2}at^2$ using graphical method where the terms have usual meaning.
4. Explain the terms the average velocity and instantaneous velocity. When are they equal?
5. A ball is thrown vertically upwards with a velocity of $20ms^{-1}$ from the top of a multi-storey building. The height of the point from where the ball is thrown is 25.0 m from the ground.
6. (a) How high will the base rise? and (b) how long will it be before the ball hits the ground? Take $g = 10ms^{-2}$. (actual value is $9.8ms^{-2}$)
7. A car travels the first third of a distance with a speed of 10 kmph, the second third at 20 kmph and the last third at 60 kmph. What is its mean speed over the entire distance?
8. A bullet moving with a speed of $150ms^{-1}$ strikes a tree and penetrates 3.5 cm before stopping. What is the magnitude of its retardation in the tree and the time taken for it to stop after striking the tree?
9. A particle moves in a straight line with uniform acceleration. Its velocity at time $t = 0$ is V_1 and at time $t = t$ is V_2. The average velocity of the particle in this time interval is $\frac{V_1 + V_2}{2}$. Is this correct? Substantiate your answer.
10. A parachutist flying in an aeroplane jumps when it is at a height of 3 km above ground. He opens his parachute when he is about 1 km above ground. Describe his motion.
11. Can the velocity of an object in a direction other than the direction of acceleration of the object? If so, give an example.
12. A ball is dropped from the roof of a tall building and simultaneously another ball is thrown horizontally with some velocity from the same roof. Which ball lands first? Explain your answer.

MOTION IN A PLANE

1. State parallelogram law of vector addition. Derive an expression for the magnitude and direction of the resultant vector.
2. S.T. the trajectory of an object thrown at certain angle with the horizontal is a parabola.
3. S.T. the maximum height and range of a projectile are $\frac{u^2 \sin^2\theta}{2g}$ and $\frac{u^2 \sin 2\theta}{g}$ respectively where the terms have their regular meanings.
4. Define unit vector, null vector and position vector.
5. Show that the maximum height reached by a projectile launched at an angle of 45° is one quarter of its range.
6. If $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$ prove that the angle between $\vec{a}$ and $\vec{b}$ is 90°.

7. Show that a boat must move at an angle 90° with respect to river water in order to cross the river in minimum time?
8. A bird holds a fruit in its beak and flies parallel to the ground. It lets go of the fruit at some height. Describe the trajectory of the fruit as it falls to the ground as seen by

   (a) the bird (b) a person in the ground)
9. What is relative motion. Explain it?
10. If the trajectory of a body is parabolic in one reference frame, can it be parabolic in another reference frame that moves at constant velocity with respect to the first reference frame? If the trajectory can be other than parabolic, what else it can be?

LAWS OF MOTION

1. Define the terms momentum and impulse. State and explain the law of conservation of linear momentum. Give examples.
2. Why is pulling lawn roller is preferred to pushing it.
3. State the laws of rolling friction.
4. Mention the methods used in decreasing friction.
5. Define angle of friction and angle of repose S.T. angle of friction is equal to angle of repose for a rough inclined plane.
6. Explain advantages and disadvantages of friction.
7. Explain the terms limiting friction, dynamic friction and rolling friction.

WORK, ENERGY AND POWER

1. S.T. in the case of one dimensional elastic collision the relative velocity of approach of two colliding bodies before collision is equal to relative velocity of separation after collisions.
2. Derive an expression for the height attained by a freely falling body after 'n' number of rebounds from the floor.
3. S.T. two equal masses undergo oblique elastic collision will move at right angles after collision, if the second body is initially at rest.
4. What is potential energy? Derive an expression for gravitational potential energy.
5. State and explain work energy theorem.
6. Define kinetic energy. Deduce the expression for kinetic energy of a body.
7. Distinguish between conservative and non-conservative forces with one example each..
8. A pump is required to lift 600 kg of water per minute from a well 25m deep and to eject it with a speed of $50 ms^{-1}$. Calculate the power required to perform the above task?
9. Explain the law of conservation of energy?

SYSTEMS OF PARTICLES AND ROTATIONAL MOTION

1. Define vector product. Explain the properties of a vector product with two examples.
2. State and prove law of conservation of angular momentum. Explain with examples.
3. Define angular velocity. Derive $v = rw$.

4. Define angular accelerations and torque. Establish a relation between angular acceleration and torque.
5. Derive expressions for the final velocity and total energy of a body rolling without slipping.
6. Distinguish between centre of mass and centre of gravity.
7. Explain about the centre of mass of earth-moon system and its rotation around the sun.
8. Find torque of a force $7\bar{i}+3\bar{j}-5\bar{k}$ about the origin. The force acts on a particle whose position vector is $\bar{i}-\bar{j}+\bar{k}$.
9. Find the scalar and vector products of two vectors $a=\left(3\hat{i}-4\hat{j}+5\hat{k}\right)$ and $b=\left(-2\hat{i}+\hat{j}-3\hat{k}\right)$

OSCILLATIONS

1. Define simple harmonic motion? Give two examples.
2. Obtain an equation for the frequency of oscillations of spring of force constant k to which a mass m is attached.
3. Derive expressions for the kinetic energy and potential energy of a simple harmonic oscillator.
4. Derive the expressions for displacement velocity and acceleration of a particle executing S.H.M.

GRAVITATION

1. What is orbital velocity? Obtain an expression for it.
2. What is escape velocity? Obtain an expression for it.
3. What is a geostationary satellite? State its uses
4. Derive an expression for the variation of acceleration due to gravity

   a) above and b) below the surface of the earth.
5. Derive the relation between acceleration due to gravity(g) at the surface of a planet and gravitational constant (G).

MECHANICAL PROPERTIES OF SOLIDS

1. Define modulus of elasticity, stress, strain and poisons ratio.
2. Define Young's modulus, bulk modulus and shear modulus.
3. Define strain energy and derive the equation for the same.
4. Describe the behaviour of a wire under gradually increasing load.
5. Define stress and explain the types of stress.
6. Define strain and explain the types of strain.

MECHANICALPROPERTIES OF FLUIDS

1. Mention any two examples that obey Bernoulli's theorem and justify them.
2. State Pascal's law and verify it with the help of an experiment.
3. Explain hydraulic lift and hydraulic brakes.
4. What is Toricellis law? Explain how the speed of efflux is determined with an experiment.
5. What is venturimeter? Explain how it is used.

6. Explain surface tension and surface energy.
7. Explain dynamic lift with examples.
8. Explain how surface tension can be measured experimentally?
9. What is Reynold's number? What is its significance?
10. What is atmospheric pressure and how is it determined using Barometer?
11. What is gauge pressure and how is a manometer used for measuring pressure differences?
12. What is hydrostatic paradox?

THERMAL PROPERTIES OF MATTER

1. Explain Celsius and Fahrenheit scales of temperature. Obtain the relation between Celsius and Fahrenheit scales of temperature.
2. Explain thermal conductivity and coefficient of thermal conductivity. A copper bar of thermal conductivity 401 W/(mK) has one end at $104°C$ and the other end at $24°C$. The length of the bar is 0.10 m and the cross sectional area is $1.0\times10^{-6}m^2$. What is the rate of heat conduction, along the bar?
3. State and explain Newton's law of colling. State the conditions under which Newton's law of cooling is applicable. A body cools down from $60°C$ to $50°C$ in 5 minutes and to $40°C$ in another 8 minutes. Find the temperature of the surroundings.
4. In what way is the anomalous behaviour of water advantageous to aquatic animals?
5. Write a short note on triple point of water.
6. A body cools from $60°C$ to $40°C$ in 7 minutes. What will be its temperature after next 7 minutes if the temperature of its surroundings is $10°C$?
7. State Boyle's law and Charle's law. Hence, derive ideal gas equation.

THERMODYNAMICS

1. State and explain first law of thermodynamics.
2. Define two principal specific heats of a gas which is greater and why?
3. Derive a relation between the two specific heat capacities of gas, on the basis of first law of thermodynamics.
4. Obtain an expression for work done by an ideal gas during isothermal change.
5. Obtain an expression for the work done by an ideal gas during adiabatic change and explain.
6. Compare isothermal and adiabatic process.

KINETIC THEORY

1. What is the relation between pressure and kinetic energy of a gas molecule.
2. Explain the kinetic interpretation of temperature.
3. How specific heat capacity of mono atomic, diatomic and poly atomic gases can be explained on the basis of law of equipartition of energy?
4. Four molecules of a gas have speeds 1, 2, 3 and 4 km/s. Find rms speed of the gas molecule.
5. Explain the concept of absolute zero of temperature on the basis of kinetic energy.
6. What is the ratio of r.m.s. speed of oxygen and hydrogen molecules at the same temperature.
7. If a gas has 'f' degrees if freedom, find the ratio of C_P and C_V.

LONG ANSWER QUESTIONS

1. A body is moving along a circular path such that its speed always remains constant. Should be there a force acting on the body?
2. (a) State and prove law of conservation of energy in case of a freely falling body.

   (b) A machine guns fires 360 bullets per minute and each bullet travels with a velocity of $600 ms^{-1}$. If the mass of each bullet is 5 gm. Find the power of the machine gun.
3. Develop the notions of work and kinetic energy and show that it leads to work-energ theorem.
4. What are collisions? Explain the possible types of collisions? Develop the theory of one dimensional elastic collision.
5. Define S.H.M. ST. the motion of projection of a particle performing uniform circular motion, on any diameter is simple harmonic.
6. (a) S.T. the motion of a simple pendulum is simple harmonic and hence derive an equation for its time period. What is seconds pendulum?

   (b) Find the length of a simple pendulum which ticks seconds. $\left(g = 9.8 ms^{-2}\right)$
7. Derive the equation for the kinetic energy and potential energy of a simple harmonic oscillator and show that the total energy of a particle in simple harmonic motion is constant at any point on its path.
8. Define gravitational potential energy and derive an expression for it associated with two particles of masses m_1 and m_2.
9. State Bernoulli's principle. From conservation of energy in a fluid flow through a tube arrive at Bernoulli's equation. Give an application of Bernoulli's theorem.
10. Define coefficient of viscosity. Explain stoke's law and explain the conditions under which a rain drop attains terminal velocity V_r. Give the expression for V_r.
11. State Boyle's law and Charle's law. Hence derive ideal gas equation. Which of the two laws is better for the purpose of thermometry and why?
12. Derive an expression for the pressure of an ideal gas in a container from kinetic theory and hence give kinetic interpretation of temperature.
13. State and prove the principle of conservation of angular momentum. Explain the principle of conservation of angular momentum with examples.

FIITJEE
HYDERABAD CENTRES

Total No. of Questions - 26 **Reg. No.**

Total No. of Printed Pages - 2

Part - III
PHYSICS, Paper I
I.P.E BOARD MODEL PAPER-I
(English Version)

Time : 3 Hours **Max. Marks : 60**

SECTION – A

Answer all questions.
Each question carries 2 marks.
All are very short answer type questions. **10 × 2 = 20 Marks**

1. What is the discovery of C.V. Raman?
2. Distinguish between accuracy and precision.
3. Can a vector of magnitude zero, have non-zero components?
4. Can coefficient of friction be greater than one?
5. By spinning eggs on a table top. How will you distinguish a hard boiled egg from a raw egg?
6. Distinguish between centre of mass and centre of gravity.
7. What is magnus effect?
8. If the diameter of a soap bubble is 10 mm and its surface tension is 0.04 N/m, find the excess pressure inside the bubble.
9. Why gaps are left between rails on a railway track?
10. When does a real gas behave like an ideal gas?

SECTION – B

Answer any six questions.
Each question carries 4 marks.
All are short answer type questions. **6 × 4 = 24 Marks**

11. A bullet moving with a speed of $150 ms^{-1}$ strikes a tree and penetrates 3.5 cm before stopping. What is the magnitude of its retardation in the tree and the time taken for it to stop after striking the tree?
12. S.T. the trajectory of an object thrown at certain angle with the horizontal is a parabola.
13. Explain the terms limiting friction, dynamic friction and rolling friction.
14. Define kinetic energy. Deduce the expression for kinetic energy of a body.

15. Define angular velocity. Derive $v = rw$.

16. Obtain an equation for the frequency of oscillations of spring of force constant k to which a mass m is attached.

17. What is escape velocity? Obtain an expression for it.

18. Define Young's modulus, bulk modulus and shear modulus.

19. State Pascal's law and verify it with the help of an experiment.

20. Explain thermal conductivity and coefficient of thermal conductivity. A copper bar of thermal conductivity 401 W/(mK) has one end at $104°C$ and the other end at $24°C$. The length of the bar is 0.10 m and the cross sectional area is $1.0 \times 10^{-6} m^2$. What is the rate of heat conduction, along the bar?

21. Define two principal specific heats of a gas which is greater and why?

22. What is the ratio of r.m.s. speed of oxygen and hydrogen molecules at the same temperature.

SECTION – C

Answer any two of the following.
Each question carries 8 marks.
All are long answer type questions. **2 × 2 = 16 Marks**

23. Develop the notions of work and kinetic energy and show that it leads to work-energ theorem.

24. Define gravitational potential energy and derive an expression for it associated with two particles of masses m_1 and m_2.

25. Define coefficient of viscosity. Explain stoke's law and explain the conditions under which a rain drop attains terminal velocity V_r. Give the expression for V_r.

26. Derive an expression for the pressure of an ideal gas in a container from kinetic theory and hence give kinetic interpretation of temperature.

FIITJEE
HYDERABAD CENTRES

Total No. of Questions - 26 **Reg. No.**
Total No. of Printed Pages - 2

Part - III
PHYSICS, Paper I
I.P.E BOARD MODEL PAPER-II
(English Version)

Time : 3 Hours **Max. Marks : 60**

SECTION – A

Answer all questions.
Each question carries 2 marks.
All are very short answer type questions. **10 × 2 = 20 Marks**

1. What is the contribution of S. Chandra Sekhar to physics?
2. The error in measurement of radius of a sphere is 1%. What is the error in the measurement of volume?
3. What is the acceleration of a projectile at the top of its trajectory?
4. What happens to the coefficient of friction if the weight of the body is doubled?
5. Explain about the centre of mass of earth-moon system and its rotation around the sun.
6. If the polar ice caps of the earth were to melt, what would the effect of the length of the day be?
7. What is angle of contact? What are its values for pure water and mercury?
8. Give an expression for the excess pressure in a liquid drop?
9. Why do liquids have no linear and areal expansions?
10. For a solid, what is the total energy of an oscillator?

SECTION – B

Answer any six questions.
Each question carries 4 marks.
All are short answer type questions. **6 × 4 = 24 Marks**

11. Derive the equation $x = v_0 t + \frac{1}{2}at^2$ using graphical method where the terms have usual meaning.
12. Show that a boat must move at an angle 90° with respect to river water in order to cross the river in minimum time?
13. S.T. in the case of one dimensional elastic collision the relative velocity of approach of two colliding bodies before collision is equal to relative velocity of separation after collisions.
14. Derive an expression for the height attained by a freely falling body after 'n' number of rebounds from the floor.

15. Find the scalar and vector products of two vectors $a = \left(3\hat{i} - 4\hat{j} + 5\hat{k}\right)$ and $b = \left(-2\hat{i} + \hat{j} - 3\hat{k}\right)$

16. Derive the expressions for displacement velocity and acceleration of a particle executing S.H.M.

17. What is a geostationary satellite? State its uses

18. Mention any two examples that obey Bernoulli's theorem and justify them.

19. What is venturimeter? Explain how it is used.

20. Explain Celsius and Fahrenheit scales of temperature. Obtain the relation between Celsius and Fahrenheit scales of temperature.

21. Compare isothermal and an adiabatic process.

22. Explain the kinetic interpretation of temperature.

SECTION – C

Answer any two of the following.
Each question carries 8 marks.
All are long answer type questions. **2 × 2 = 16 Marks**

23. What are collisions? Explain the possible types of collisions. Develop the theory of one dimensional elastic collision.

24. Derive the equation for the kinetic energy and potential energy of a simple harmonic oscillator and show that the total energy of a particle in simple harmonic motion is constant at any point on its path.

25. Derive an expression for the pressure of an ideal gas in a container from kinetic theory and hence give kinetic interpretation of temperature.

26. State and prove the principle of conservation of angular momentum. Explain the principle of conservation of angular momentum with examples.

PHYSICS DELETED QUESTIONS 2020-2021

LAWS OF MOTION

VSAQ

1. What is inertia? What gives the measure of inertia?

MECHANICAL PROPERTIES OF SOLIDS

VSAQ

2. What are the theoretical and practical limits of poisson's ratio?

THERMODYNAMICS

VSAQ

3. Why a heat engine with 100% efficiency can never be realised in practice?

SAQ

4. Explain qualitatively the working of a heat engine.

SYSTEM OF PARTICLES AND ROTATIONAL MOTION

SAQ

5. State and prove perpendicular axes theorem.
6. State and prove parallel axes theorem.

GRAVITATION

SAQ

7. State Kepler's laws of planetary motion.
8. State Newton's law of gravitation. Explain how the value of gravitational constant (G) can be determined by Cavendish method.
9. How does the acceleration due to gravity(g) change for the same values of height (h) and depth (d).

MECHANICAL PROPERTIES OF SOLIDS

SAQ

10. Define Hooke's law of elasticity and describe an experiment to determine the Young's modulus of the material of a wire.
11. Explain the concept of Elastic Potential Energy in a stretched wire and hence obtain the expression for it.

THERMAL PROPERTIES OF MATTER

SAQ

12. Explain conduction, convection and radiation with examples.
13. Explain conduction, convection and radiation with examples.

LONG ANSWER QUESTIONS

14. State Newton's second law of motion. Hence derive the equation of motion $f = ma$ from it.
15. Explain reversible and irreversible processes. Describe the working of carnot engine. Obtain an expression for its efficiency.
16. State second law of thermodynamics. How heat engine is different from refrigerator?