Indian School Al Wadi Al Kabir
Final Examination 2024-2025

Class: XI | Subject: Physics (042) | Max. marks: 70
Date: 26/02/2025 | SET-I | Time: 3 hours

GENERAL INSTRUCTIONS

(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each and Section E contains three long answer questions of five marks each.
(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever necessary

SECTION-A **(16 x 1 = 16 marks)**

1. A body is thrown upward and after some time the body reaches its maximum height. At maximum height:

   (a) Its velocity and acceleration both are zero.
   (b) Its velocity is zero and acceleration is maximum.
   (c) Its velocity is maximum and acceleration is minimum.
   (d) Its velocity is zero and acceleration is equal to acceleration due to gravity (g).

2. A ball is thrown vertically upward with an initial velocity of 50 m/s. What is its maximum height?
   (a) 250m
   (b) 125m
   (c) 500 m
   (d)100 m

3. Consider 2 balls A and B of same mass. The potential energy of ball A is thrice that of ball B. How high is ball A compared to ball B?
   (a) Same height as ball B
   (b) Twice as high as ball B
   (c) Thrice as high as ball B
   (d) Four times as high as ball B

4. A body of mass 1kg is thrown upwards with a velocity 20 m/s. It momentarily comes to rest after attaining a height of 18m. How much energy is lost due to air friction? (Take g = 10 m/s^2)

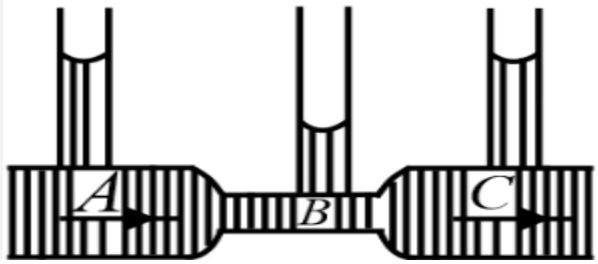
(a) 20J
(b) 200J
(c) 180J
(d) 40J

5. Far out in space the gravitational field strength experienced is negligible. The rocket motor of a space probe is fired for a short time and the rocket accelerates. What will happen to the rocket when the motor is switched off?
   (a) The rocket decelerates until it comes to rest.
   (b) The rocket will continue to accelerate forward.
   (c) The rocket will change direction.
   (d) The rocket will move at a constant velocity.

6. Ten seconds after an electric fan is turned on, the fan rotates at 300 rev/min. Its average angular acceleration is:
   (a) 3.14 rad/s^2
   (b) 30 rad/s^2
   (c) 30 rev/s^2
   (d) 50 rev/min^2

7. A child is standing with folded hands at the centre of a platform rotating about its central axis. The kinetic energy of the system is K. The child now stretches his arms so that the moment of inertia of the system doubles. The kinetic energy of the system now is
   (a) 2K
   (b) K/ 2
   (c) K/ 4
   (d) 4K.

8. The following figure shows the flow of liquid through a horizontal pipe. Three tubes A, B and C are connected to the pipe. The radii of the tubes A, B and C at the junction are respectively 2cm, 1cm and 2cm. It can be said that the



   (a) height of the liquid level in the tube A is maximum
   (b) height of the liquid level in the tubes A and B is the same
   (c) height of the liquid level in all the 3 tubes is the same
   (d) height of the liquid level in the tubes A and C is the same

9. Specific heat of a substance at the melting point becomes
   (a) low
   (b) high
   (c) remains unchanged
   (d) infinite

10. Two cylinders A and B of equal capacity are connected to each other via a stopcock. A contains a gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. What is the pressure of the gas on B?
    (a) 1 atm
    (b) 0.5 atm
    (c) 2 atm
    (d) 0.25 atm

11. In kinetic theory of gases, it is assumed that:
    (a) the collisions are not perfectly elastic.
    (b) the molecular collisions change the density of the gas.
    (c) the molecules don't collide with each other or on the walls of the container.
    (d) between two collisions the molecules travel with uniform velocity.

12. When two waves of the same frequency and amplitude are superimposed in phase, the resulting wave will have:
    (a) Higher amplitude
    (b) Higher frequency
    (c) Lower frequency
    (d) Lower amplitude

For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C. If Assertion is true but Reason is false.
D. If both Assertion and Reason are false.

13. **Assertion(A):** It is harder to open and shut the door if we apply force near the hinge.
    Reason(R): Torque is maximum at the hinge of the door.
14. **Assertion(A):** Two bodies at different temperatures, if brought in thermal contact do not necessary settle to the mean temperature.
    Reason(R): The two bodies may have different thermal capacities.
15. **Assertion(A):** A body becomes weightless at the centre of earth.
    Reason(R): As the distance from the centre of the earth to the surface decreases, acceleration due to gravity increases.
16. **Assertion(A)**: The specific heat of a gas is an adiabatic process is infinite and in an isothermal process is zero.
    Reason(R): Specific heat of a gas is inversely proportional to change of heat in system and directly proportional to change in temperature.

[SECTION – B] (5x2=10 marks)

17. A boy standing on a stationary lift (open from above) throws a ball upwards with the maximum initial speed he can, equal to $49 ms^{-1}$. How much time the ball takes to return to his hands?

18. Check by using the principle of homogeneity whether the formula is dimensionally correct or not.

$$T = \sqrt{\frac{4\pi^2 r^3}{GM}}$$

where T is the time period, r the radius, G the gravitational constant and M the mass.

OR

In the given expression P is pressure and V is the volume. Calculate the dimensions of a and b.

$$\left(P+\frac{a}{v^2}\right)(v-b)=RT$$

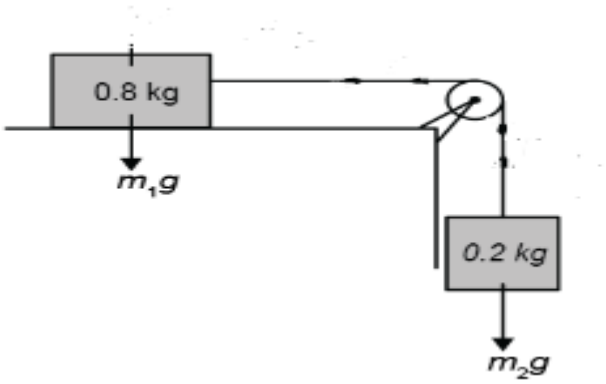
19. State conservation of angular momentum. Explain using an example.

20. Which is more dangerous, burns produced by boiling water at 100ºC or burns produced by steam at 100ºC? Explain with reason.

21. A simple wave has the equation Y= 0.30 Sin (314 t- 1.57x), where t is in sec, x in meters, y in cm. Find the frequency and wave velocity of this wave.

[SECTION – C] **(7x3=21 marks)**

22. A wooden block of mass 0.8 kg is dragged along a levelled frictionless surface by a hanging block of mass 0.2 kg as shown in the figure. Calculate the tension in the string and the acceleration of the system by drawing a diagram showing the direction of tension and acceleration.



23. State law of conservation of mechanical energy and prove it by taking the case of a freely falling body. Draw a graph showing the variation of kinetic energy and potential energy with distance.

24. (i) State what is free fall.
(ii) Find the percentage decrease in the weight of a body when taken to a height of 32 km above the surface of the earth. (R = 6400 km)

OR

An artificial satellite of mass 100 kg is in a circular orbit at 500 km above the earth's surface.
(i) Find the acceleration due to gravity at any point along the satellite path.
(ii) What is the centripetal acceleration of the satellite? (Take R = 6.5 x 10^6 m)

25. (i) Bridges are declared unsafe after long use. Why?
(ii) A 5 cm cube has its upper face displaced by 0.2 cm by a tangential force of 8 N. Calculate the shearing strain, shearing stress and modulus of rigidity of the material of the cube.

26. State stokes law and derive an expression for it.

27. (i) State any one postulate of kinetic theory of gases.
(ii) State law of equipartition of energy and derive the ratio of the molar specific heats for a diatomic gas.

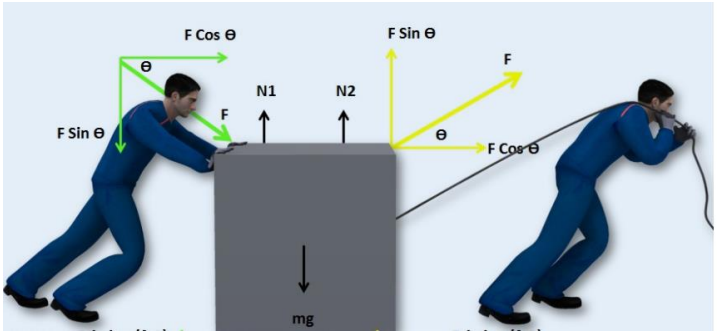
28. Derive an expression for kinetic energy, potential energy and total energy of a particle executing simple harmonic motion.

[SECTION D] **(02x4=08 marks)**

Case Study Based Question:

29. Read the passage given below and answer the questions

Friction is the force that resists motion when the surface of one object comes in contact with the surface of another. An automobile uses one-quarter of its energy on limiting the friction. Yet, it is also friction in the tyres that allows the car to stay on the road and friction in the clutch that makes it possible to drive. From matches to machines to molecular structures, friction is one of the most significant phenomena in the physical world. Friction is a necessary evil. It has its own advantages and disadvantages.



(i) Which is easier, to pull an object or to push it?

(a) To push, as the normal component of force acts along the direction of motion.
(b) To pull, as the normal component of force acts opposite to the direction of motion.
(c) To pull, as the frictional force get reduced during pulling.
(d) To push, as the frictional force get reduced during pushing.

(ii) Determine the maximum acceleration of the train in which a box lying on its floor will remain stationary. Given that the coefficient of static friction between the box and the floor of the train is 0.25. Take g = 10 m/s^2.

(a) 1.5 m/s^2
(b) 2.5 m/s^2
(c) 3.0 m/s^2
(d) 1.0 m/s^2

(iii) What happens to the coefficient of friction when the weight of the body is doubled?

(a) Coefficient of friction becomes half
(b) Coefficient of friction becomes double
(c) Coefficient of friction becomes one fourth
(d) Coefficient of friction remains the same

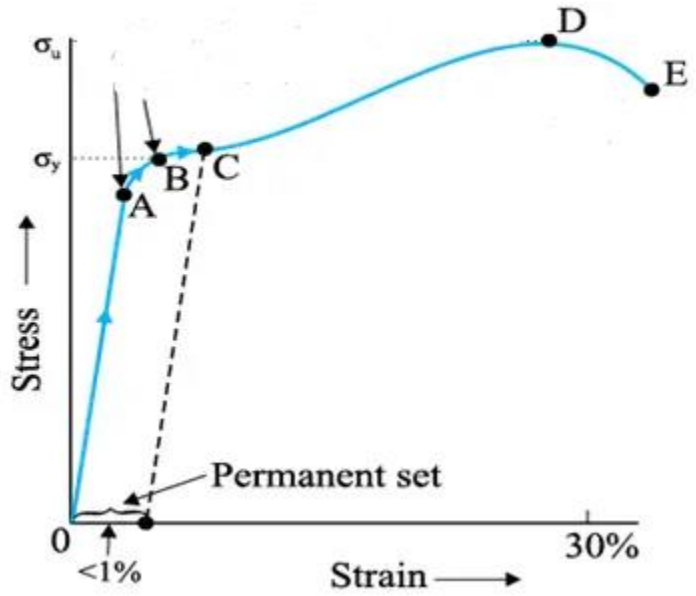
OR

Which among the following is the i) largest and ii) the smallest of all?

(a) Kinetic friction and Rolling friction
(b) Static friction and Kinetic friction
(c) Limiting friction and rolling friction
(d) Rolling friction and Limiting friction

(iv) The angle between the frictional force and instantaneous velocity is
(a) 90^o (b) 0^o (c) 45^o (d) 180^o

30. **Case Study Based Question:**
Elasticity refers to the ability of a material or object to deform under stress and return to its original shape or position once the stress is removed. It is a physical property that determines how much a material can stretch or bend without permanently altering its structure or integrity. Elasticity is often quantified by parameters such as the modulus of elasticity or Young's modulus, which describe the material's resistance to deformation. Understanding elasticity is crucial in fields such as materials Science, engineering, and biomechanics for designing structures, predicting behavior, and ensuring performance and safety. Below is the stress- strain curve of an elastic material. Study the graph and answer the following.



(i) The point A corresponds to
(a) Proportional limit (b) Plastic region (c) Fracture point (d) Permanent set

(ii) The stress corresponding to the highest point D is called is called
(a)Yield strength (b) Elastic limit (c) Tensile strength (d) Compressional stress

(iii) If deforming forces are removed, up to which point the curve will be retraced?
(a) up to *OA* only
(b) up to *OB*
(c) up to *C*
(d) Never retraces its path

OR

Slope of the above graph gives
(a) Bulk modulus
(b) Shear strain
(c) Rigidity modulus
(d) Young's modulus

(iv) The length of a suspended wire increases by 10^{-4} of its original length when a stress of 10^7 Nm^{-2} is applied on it. The Young's modulus of the material of the wire is

(a) 10^{11} N/m^2
(b) 10^{9} N/m^2
(c) 10^{-11} N/m^2
(d) 10^{10} N/m^2

SECTION E **(3 x 5 = 15)**

31. (i) A projectile is fired making an angle Θ with the horizontal. Find the (i) maximum height (ii) time of flight and the horizontal range of projection.
(ii) Prove that the maximum horizontal range is four times the maximum height attained by a projectile which is fired along the required oblique direction.

OR

(i) State parallelogram law of vector addition. Show that resultant of two vectors A and B inclined at an angle Θ is R = $\sqrt{A^2 + B^2 + 2AB\,cos\,\theta}$
(ii) Two equal velocities have a resultant equal to 3/2 times the value of either velocity. Find the cosine of the angle between them.

32. State and prove Bernoulli's theorem with suitable diagram and explain an application of Bernoulli's theorem.

OR

(i) Define terminal velocity and derive its expression for a spherical body falling through a viscous medium.
(ii) State and discuss Pascal's law with an example.

33. (i) What is simple harmonic motion? Derive an expression for time period of a simple pendulum with the help of diagram.
(ii) The maximum velocity of a particle executing simple harmonic motion with an amplitude of 7 mm is 4.4m/s. What is its time period of oscillation?

OR

(i) Derive an expression to find the total energy of a particle executing simple harmonic motion.
(ii) Represent graphically, the variations of energy with displacement.
(iii) The amplitudes of oscillation of two simple pendulums similar in all respects are 2 cm and 5 cm respectively. Find the ratio of their energies of oscillations.