# BUDHA DAL PUBLIC SCHOOL, PATIALA
## Final Examination (28 February 2024)
### Class XI (Science)
### Subject - Physics
### (Set - A)

Time: 3hrs                                                                M.M. 70

**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 16 questions, 12 MCQ and 4 Assertion Reasoning based of 1 mark each, **Section B** contains 5 questions of two marks each, **Section C** contains 7 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) Use of calculators is not allowed.

## Section - A

**Q1.** A shell is fired from a cannon, it explodes in mid air, its total

  a) Momentum increases    b) Momentum decreases    c) KE increases    d) KE decreases

**Q2.** If I, $\alpha$ and $\tau$ are moment of inertia, angular acceleration and torque respectively of a body rotating about any axis with angular velocity $\omega$, then

  a) $\tau = I\alpha$      b) $\tau = I\omega$      c) $I = \tau\omega$      d) $\alpha = \tau\omega$

**Q3.** The time period of a second's pendulum in a satellite is

  a) zero      b) 2      c) infinity      d) depends on mass of body

**Q4.** In which of the following process, convection does not take place primarily?

  a) Sea and land breeze

  b) boiling of water

  c) warming of glass of bulb due to filament

  d) heating air around a furnace

**Q5.** Suppose there is a hole in a copper plate. Upon heating the plate, diameter of hole would

  a) always increase  b) always decrease     c) remains the same  d) none of the above

**Q6.** According to first law of thermodynamies

  a) heat neither enters nor leaves the system

  b) heat is constant in isothermal system

  c) energy is conserved

  d) none of these

**Q7.** In ideal gas the size of a molecule is negligible compared with the _____ between the molecules.

**Q8.** A parrot sitting on the floor of a wire cage which is being carried by a boy starts flying. The boy will feel that the box is now :

  a) heavier    b) lighter    c) shows no change in weight    d) lighter in beginning and heavier later

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**Q9.** A long spring is stretched by 2 cm and its potential energy is V. If the spring is stretched by 10 cm, its potential energy will be :

    a) V/5     b) V/25     c) 5V     d) 25V

**Q10.** With propagation of longitudinal waves through a medium, the quantity transmitted is

    a) matter     b) energy     c) energy and matter     d) energy, matter and momentum

**Q11.** Water waves produced by a motor boat sailing in water are

    a) neither longitudinal nor transverse
    b) both longitudinal and transverse
    c) only longitudinal
    d) only transverse

**Q12.** For a particle executing SHM along x-axis force is given by

    a) $-kx$     b) $A\cos kx$     c) $A\exp(-kx)$     d) $A\,kx$

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as:

    a) Both Assertion (A) and Reason (R) true and Reason (R) is the correct explanation of Assertion (A).
    b) Both Assertion (A) and Reason (R) are true but Reason (R) is not a correct explanation of Assertion (A).
    c) Assertion (A) is true but Reason (R) is false.
    d) Assertion (A) is false and Reason (R) is also false.

**Q13.** Assertion (A) : Water flows faster than honey.

Reason (R) : The coefficient of viscosity of water is less than the honey.

**Q14.** Assertion (A) : For a perfectly incompressible substance, bulk modulus is infinity.

Reason (R) : Bulk modulus of elasticity is directly proportional to change in volume.

**Q15.** Assertion (A) : In SHM, the motion is to and fro and periodic.

Reason (R) : Velocity of the particle $v = \omega\sqrt{A^2 - x^2}$ (where $x$ is displacement)

**Q16.** Assertion (A) : The blood pressure in humans is greater at the feet than at the brain.

Reason (R) : Pressure of liquid at any point is proportional to height, density of liquid and acceleration due to gravity.

### Section - B

**Q17.** A body covers 21 m in 2nd second and 20m in 4th second. Find what distance the body will cover in 4 second after 5th second.

<div align="center">OR</div>

A particle starts from rest, and its acceleration (a) plotted against time (t) is shown here. Plot the corresponding velocity (v) against time (t). Also plot the corresponding displacement (s) against time (t).



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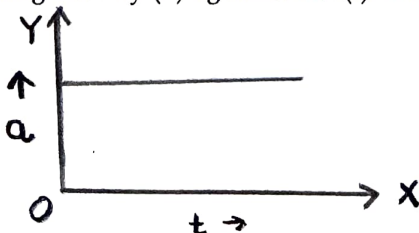
18. Discuss the variation of 'g' with depth. What happens to 'g' at the centre of earth?

Q19. What is meant by elastic potential energy? Derive an expression for the elastic potential energy of a stretched wire. Prove that its elastic energy density is equal to ½ stress × strain.

Q20. Toricelli's barometer uses mercury. Pascal duplicated it using French wine of density 984 kgm⁻³. Determine the height of the wine column for normal atmospheric pressure.

Q21. A particle is executing S.H.M. Identify the positions of the particle where

   a) K.E. of the particle is zero.

   b) P.E. is one fourth of the total energy

## Section - C

Q22. Two blocks 3kg and 2kg are suspended from a rigid support by two inextensible wires, each of length 1 m and having linear mass density 0.2 kg/m. Find the tension at the mid-point of each wire as the arrangement gets an upward acceleration of 2 m/s².
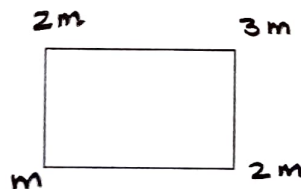
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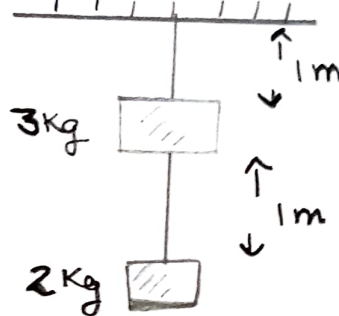


OR

Consider a mass 'm' attached to a string of length '$\ell$' performing vertical circle. Find an expression for the

   a) velocity at any point

   b) tension at any point

   c) velocity minimum at the lower-most point for a vertical circle

Q23. Four bodies have been arranged at the corners of a rectangle shown in figure. Find the centre of mass of the system.



Q24. A liquid is in streamlined flow through a tube of non-uniform cross-section. Prove that sum of its kinetic energy, pressure energy and potential energy per unit volume remain constant.

Q25. Derive an expression for pressure of a gas in a container. Using it, relate K.E. with pressure.

Q26. Define molar specific heat capacities at constant volume and pressure. Considering thermodynamical process in a cylinder with parameters P, V and T, derive the Mayer's relation.

Q27. Show that for small oscillations the motion of a simple pendulum is simple harmonic. Derive an expression for its time period. Does it depend on the mass of the bob?

Q28. Write Newton's formula for the speed of sound in air. Discuss the correction made by Laplace in this formula.

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**Q29.** Read the following paragraph and answer the questions that follow.

It is observed that if gravity effect is neglected the pressure at every point of liquid in equilibrium of the liquid. rest is same and the increase in pressure at one point of the enclosed liquid in equilibrium of rest is transmitted equally to all other points of This is accounted to Pascal's law. Hydraulic lift and hydraulic brakes working is based on the Pascal's law, in which a small force applied on the smaller piston will appear as a very large force on the large piston.

**Based on the above information, answer the following:**

(i) Which law states that the increase in pressure at one point of the enclosed liquid in equilibrium of rest is transmitted equally at all other points of the liquid?

(a) Stoke's Law     (b) Pascal's Law     (c) Bernoulli's Law     (d) None of these

(ii) Two pistons of hydraulic press have diameter of 30 cm and 2.5 cm. The force exerted by longer piston when 50 kg wt is placed on smaller piston is:

(a) 6250 kg wt     (b) 5120 kg wt     (c) 7200 kg wt     (d) 8000 kg wt

(iii) From the above question, the distance through which the longer piston would move after 10 strokes if the stroke of the smaller piston is 40 cm:

(a) 1.001 cm     (b) 0.015 cm     (c) 0.001 cm     (d) 0.028 cm

(iv) On the Pascal's law working is based

(a) Hydraulic pressure, hydraulic lift

(b) Hydraulic lift, hydraulic brakes

(c) Hydrodynamics, hydraulic brakes

(d) Hydrostatic paradox, thrust

**OR**

(v) A slight blow on the tight cork may be sufficient to break the bottle due to

(a) increase in volume     (b) decrease in pressure     (c) increase in pressure     (d) decrease in volume

**Q30.** Read the following paragraph and answer the questions that follow.

Thermodynamics is the study of transformation of heat into other forms of energy and vice-versa. Thermodynamical system is said to be in equilibrium when macroscopic variables like pressure, volume, temperature, mass, composition etc. that characterise the system variables which are not necessarily independent. Some important thermodynamic processes are: isothermal, adiabatic, isobaric, and isochoric. A thermodynamic state is represented by equation of state that represents the connection between the state variables of a system.

(i) Which physical quantity determine the thermal equilibrium of a system?

(a) Temperature     (b) Volume     (c) Pressure     (d) Both (a) and (b)

(ii) Thermodynamic process in which state variables of the thermodynamic system are infinetly slow is called

(a) Adiabatic process     (b) Isothermal process     (c) quasi-static process     (d) Equilibrium process

(iii) The equation of state for adiabatic operation

(a) $P^\gamma V$     (c) $P V^\gamma$     (b) $P^{\gamma-1}V$     (d) $P V^{\gamma-1}$

(iv) An ideal gas at temperature $T_1$ undergoes expansion under adiabatic condition, to attain temperature $T_2$. The expression for work done is :

a) $W = \frac{R(T_1 - T_2)}{(1-\gamma)}$     b) $W = \frac{R(T_1 - T_2)}{(\gamma)}$     c) $W = \frac{R(T_2 - T_1)}{(1-\gamma)}$     d) $W = \frac{R(T_1 - T_2)}{(\gamma-1)}$

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## Section – E

**Q31.** Explain why:

a) The angle of contact of mercury with glass is obtuse, while that of water with glass is acute.

b) Water on a clean glass surface tends to spread out while mercury on the same surface tends to form drops.

c) Surface tension of a liquid is independent of the area of the surface.

d) Water with detergent dissolved in it should have small angles of contact.

e) A drop of liquid under no external forces is always spherical in shape.

**OR**

a) Derive an expression for the excess of pressure inside a liquid drop.

b) Derive an expression for the height to which the liquid rises in a capillary tube of radius r.

**Q32.** a) Find the ratio of the time period in the cases given below:
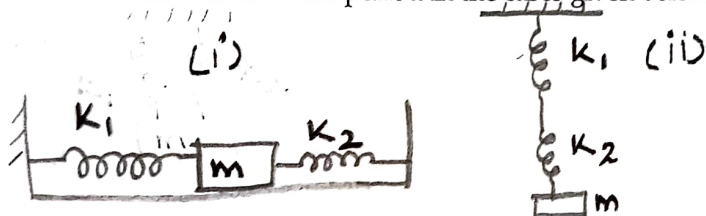


b) List any two characteristics of simple harmonic motion. and derive it also.

**OR**

a) Prove that if a liquid taken in a U-tube is disturbed from the state of equilibrium, it will oscillate simple harmonically. Find expression for time period.

b) A pendulum of length L is attached with a bob and placed in a lift. What will be time period when the lift is

i) having uniform motion upwards

ii) accelerated upwards by a

**Q33.** What are stationary waves? How are they formed in strings? Draw the various modes of vibration in them.

**OR**

a) Describe various modes of vibration in an open ends organ pipe.

b) Show that the ratio of frequencies of different harmonies with the first harmonic in open pipe is 1 : 2 : 3.

c) In an open organ pipe, the fundamental frequency is 30 Hz. If the organ pipe is closed at one end then what will be the fundamental frequency?

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