Ms Kavita

BUDHA DAL PUBLIC SCHOOL, PATIALA

Final Examination (1 March 2025)

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. If two sounds waves having a phases difference of 60^0, then they will have a path difference of

a) $\lambda/6$ b) $\lambda/3$ c) λ d) 3λ

Q2. Two stones A and B are thrown at angles θ *and* $(90^0 - \theta)$ with horizontal. The ratio of their horizontal range is

a) 1:1 b) $\tan\theta : 1$ c) $tan^2\theta : 1$ d) $1 : \tan\theta$

Q3. The vectors $\vec{P} = a\hat{\imath} + a\hat{\jmath} + 3\hat{k}$ *and* $\vec{Q} = a\hat{\imath} - 2\hat{\jmath} - \hat{k}$ are perpendicular to each other. The positive value of a is

a) 3 b) 2 c) 1 d) zero

Q4. During an adiabatic change specific heat of gas is

a) zero b) positive c) negative d) infinity

Q5. With the increase in temperature, the viscosity of a gas

a) increases b) decreases c) remains constant d) may increase or decrease

Q6. *The surface tension of soap is σ. The work done in blowing a soap bubble of diameter D to that of a diameter 2 D is*

a) $2\pi D^2\sigma$ b) $4\pi D^2\sigma$ c) $6\pi D^2\sigma$ d) $8\pi D^2\sigma$

Q7. The escape velocity and orbital velocity are related as

a) $v_0 = \sqrt{2}\, v_e$ b) $v_0 = 2\, v_e$ c) $v_e = \sqrt{2}\, v_o$ d) $v_0 = 2\, v_o$

Q8. If ε_1 *and* ε_2 are the strains produced in succession in a material, then the total true strain is

a) $\varepsilon_1/\varepsilon_2$ b) $\varepsilon_2 - \varepsilon_1$ c) $\varepsilon_1 + \varepsilon_2$ d) $\varepsilon_1 \times \varepsilon_2$

Q9. A child, swinging on a swing in sitting position, stands up. Then, the time period of swing will

a) increase b) decrease c) remains same

d) increase, if the child is long and decrease, if child is short

Q10. A mass of 10 kg is suspended by a rope of length 4m, from the ceiling. A force F is applied horizontally at the mid-point of the rope such that the top half of the rope makes an angle of 45^0 with the vertical. Then F equals : [Take, g = 10 ms^{-2} and the rope to be massless]

a) 100 N b) 90 N c) 70 N d) 75 N

Q11. The moment of inertia of a body does not depend upon its

a) Nature of distribution of mass b) Angular velocity

c) Axis of rotation d) Different orientation of body

A-1

Q12. A body has uniform circular motion. Which of the quantity of the body will remain the same?

a) Velocity b) Momentum c) K.E. d) Both of velocity and momentum

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) :** It is not possible for a system, unaided by an external agency to transfer heat from a body at lower temperature to another body at higher temperature.

Reason (R) : According to Clausis statement, "No process is possible whose sole result is the transfer of heat from a colder object to hotter object."

Q14. **Assertion (A) :** A hollow shaft is found to be stronger than a solid shaft made of the same material.

Reason (R) : The torque required to produce a given twist in hollow cylinder is greater than that required to twist a solid cylinder of same size and material.

Q15. **Assertion (A) :** A needle placed carefully on the surface of water may float, whereas a ball of same material will always sink.

Reason (R) : The buoyancy on an object depends both on the material and shape of the object.

Q16. **Assertion (A) :** A hot liquid moves faster than a cold liquid.

Reason (R) : Co-efficient of viscosity of a liquid decreases with the increase of temperature.

Section - B

Q17. Derive the expressions of equation of trajectory, time of flight for a projectile thrown at an angle θ with horizontal.

Q18. Derive an expression for the rise of a liquid in a capillary tube of uniform diameter. (Ascent formula)

OR

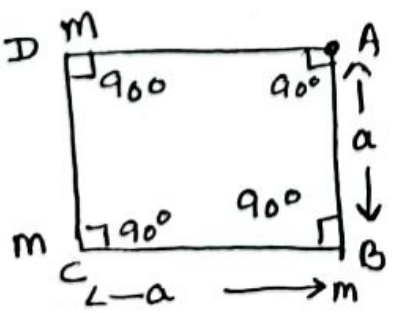
Two syringes of different cross-sections (without needles) filled with water are connected with a tightly fitted rubber tube filled with water. Diameters of smaller piston and larger piston are 1.0 cm and 3.0 cm respectively.

a) Find the force exerted on the larger piston when a force of 10N is applied to the smaller piston.
b) If the smaller piston is pushed in through 6·0 cm, how much does the larger piston move out?

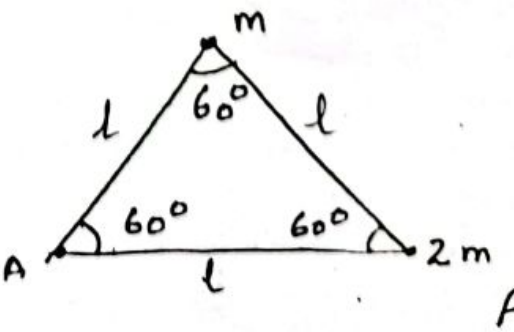
Q19. A structural steel rod has a radius of 10 mm and a length of 1.0 m. A 100 kN force stretches it along its length. Calculate (a) stress (b) elongation and (c) strain on the rod. Young's modulus, of structural steel is 2.0×10^{11} N m^{-2}.

Q20. a) Discuss how acceleration due to gravity varies with height?
b) Find the value of acceleration due to gravity at centre of earth.

Q21. Find the resultant gravitational intensity at a point A due to system of masses given in the figure.



OR

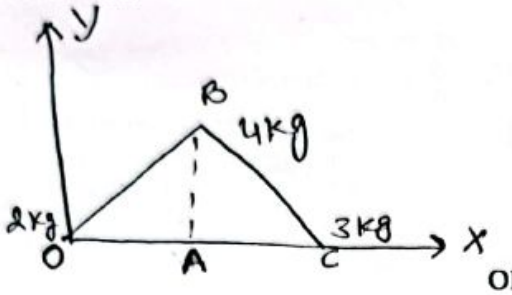


OR

What is the change in gravitational potential energy when a body of mass m is raised to height nR above the surface of earth of radius R?

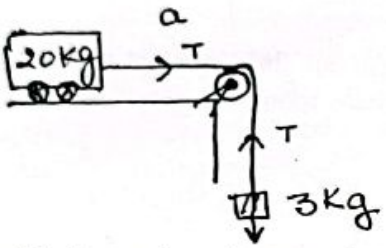
Section - C

22. Three masses 2kg, 3kg and 4kg are located at the corners of an equilateral triangle of side 1 m. Find out the position of C.M.



OR

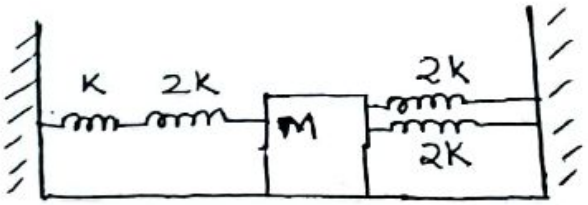
What will be the acceleration of the block and trolley system as shown in figure. If the coefficient of kinetic friction between the trolley and surface is 0.04?



What is the tension in the string? Taking $g = 10 m/s^2$

Q23. A ball is thrown from the ground so that it just crosses a wall 10m in height at a distance of 10 m and falls at a distance of 30m from the wall. Find the velocity and the direction of projection of the ball. Assume $g = 10\ m\ s^{-2}$.

Q24. Four massless springs whose force constants are 2K, 2K, K and 2K respectively are attached to mass M kept on a frictionless plane as shown in the figure. If the mass M is displaced in the horizontal direction, the frequency of the system is .....



Q25. Define orbital velocity of a satellite. Derive an expression for the orbital velocity of a satellite.

Q26. The equation of plane progressive wave is $y = 10 \sin 2\pi (t + 0.005 x)$, where y *and* x are in cm and t is in seconds. Calculate the frequency, wavelength and velocity of wave.

Q27. State and prove Bernoulli's theorem.

Q28. Explain correction done by Laplace in equation for the speed of sound in air. Name two factors which affects the speed of a sound in air.

Section - D

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

Heat flows from a body at higher temperature to a body at lower temperature. This is called as transfer of heat. There are three modes of transfer of heat: Conduction, Convection and Radiation.

In conduction the heat transfer from one point or one particle to another point or particle without the dislocation of the particles from their equilibrium position. In convection the heat transfers from one point to another point of medium by the actual or bodily motion of particles of medium. Whereas in

case of radiations heat transfer does not require a medium e.g. radiations from sun. Radiation is composed of time varying electric and magnetic fields called electromagnetic waves propagating through space.

(i) Which of the following processes is the fastest process of heat transfer?

(a) conduction (b) convection (c) radiation (d) none of these

(ii) The amount of heat conducted through a metal rod is directly proportional to

(a) time during which heat flows (b) area of cross section

(c) temperature gradient (d) all the above

(iii) Which of the following surfaces will radiate more heat at a given temperature?

(a) Black and rough (c) White and rough (b) White and polished (d) Black and polished

OR

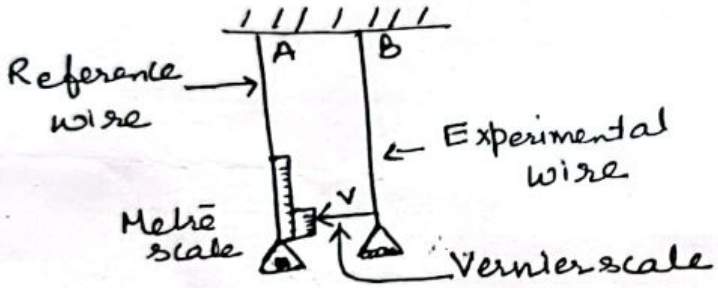
(iii) The thermal resistance of an ideal heat conductor is

a) zero b) one c) two d) infinity

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

A typical experimental arrangement to determine the Young's modules of a material of the wire under same tension is as shown in figure.

It consists of two long wires of same length and equal radii suspended side by side from a rigid support. The reference wire (A) carries a millimeter scale and pan to place the weight.



The experimental wire (B) is of uniform area of cross-section also carries a pan in which known weights can be placed. The vernier scale is attached to a pointer at the bottom of experimental wire B and main scale is fixed to the reference wire A.

Based on the above information, answer the following:

(i) On placing the weights in the pan, which type of stress is produced in it?

(a) tensile stress (b) compressive stress (c) tangential stress (d) bulk stress

(ii) The difference between which two readings gives the elongation produced in wire.

(a) original wire (b) reference wire (c) main (d) vernier

(iii) If M be the mass of the wire that produces an elongation ΔL in the wire, then applied force is equal to

(a) Ma (b) Mg (c) Mv (d) Mv^2

(iv) The Young's Modulus of experimental wire is

(a) $\frac{Mg\,L}{\pi r^2 \Delta L}$ b) $\frac{Mg \times \pi r^2 \Delta L}{Mg \times L}$ c) $\frac{\Delta L \times \pi r^2}{Mg \times L}$ d) $\frac{Mg \times \pi r^2 \times \Delta L}{(\Delta L)^2}$

OR

(iv) Identify the incorrect statement

(a) Young's modulus and shear modulus are relevant only in solids.
(b) Bulk modulus is relevant for solids, liquids and gases
(c) Alloys have larger values of Young's modulus than metals
(d) Metals have large values of Young's modulus than elastomers.

What is a simple pendulum? Show that the motion of a simple pendulum is S.H.M. and hence deduce an expression for the time period of simple pendulum. Discuss the various cases on which the time period of simple pendulum depends.

OR

a) Derive expression of excess pressure in a liquid drop.

b) Derive Stoke's law

Q32. What are stationary waves? Why are they so called? Obtain an expression for the stationary wave formed in a string fixed at both the ends, hence obtain the position of nodes and antinodes.

OR

What are beats? Discuss the formation of beats analytically. Prove that the beat frequency is equal to the difference between the frequency of two superposing waves.

Q33. Define an adiabatic process. What are conditions for a process to be adiabatic ? Derive an expression for work done during an adiabatic process.

OR

What is an isothermal process? State essential conditions for this type of process. Show analytically that the work done by one mole of the gas during an isothermal process during expansion from volume V1 to V2 is given by $W = RT \log_e \frac{V_2}{V_1}$