INDIAN SCHOOL SALALAH

ANNUAL EXAMINATION (FEBRUARY- 2019)

Class XI **PHYSICS** **Marks: 70**
Time: 3hrs.

General instructions

i. All questions are compulsory. There are **27** questions in **all**.

ii. This question paper has five sections: Section **A**, Section **B**, Section **C** and Section **D**.

iii. Section **A** contains **five** questions of **one** mark each, Section **B** contains **seven** questions of **two** marks each, Section **C** contains **twelve** questions of **three** marks each and Section **D** contains **three** questions of **five** marks each.

iv. There is no overall choice. However, internal choices have been provided in two questions of one mark, two questions of two marks, four questions of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions. Use of calculators, is not permitted.

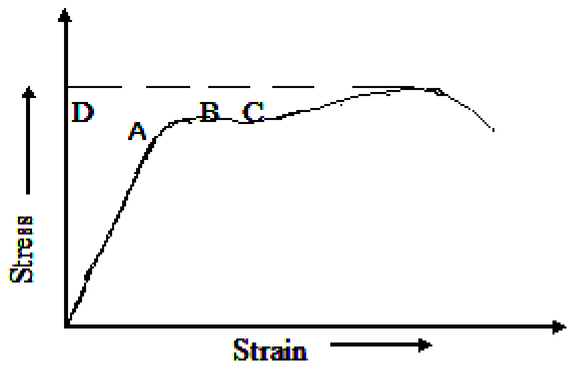
v. You may use the following values of physical constants wherever necessary:

Gravitation constant, G = 6.67 x 10^{-11}N m^2 kg^{-2}, Acceleration due to gravity, g = 9.8ms^{-2}
Boltzmann constant, k = 1.381 x 10^{-23}J/K, Avogadro number, N = 6.022 x $10^{23}$$mol^{-1}$

SECTION A

1 An object of mass **m** moves on a surface with kinetic friction F_k. What is (a) the force required to keep the object in uniform motion and (b) the retardation if the external force stops to act? **1**

2 Identify elastic limit and yield strength from the given points in the graph. **1**



3 A physical quantity is measured as Q = 2 ± 0.5 units. Calculate the percentage error in (a) Q^2 and (b) 2Q. **1**

OR

5.74g of a substance occupies in 1.2cm^3. Express its density to correct significant figures.

4 The torque acting on a body due to a tangential force is given by **1**

$$\vec{\tau} = \vec{r} \times \vec{F}$$

Identify the pairs of perpendicular vectors in the equation.

5 Both longitudinal waves and transverse waves can propagate through a steel bar, why? **1**

OR

A ray of monochromatic light passes from medium (1) to medium (2). If the angle of incidence in medium (1) is θ and the corresponding angle of refraction in medium (2) is $\theta/2$, which of the two media is optically denser? Give reason.

SECTION B

6 Two gases A and B of molecular masses m_1 and m_2 respectively are kept at same temperature, pressure and volume. Find the ratio of their (i) internal energies, (ii) number of molecules, (iii) partial pressures and (iv) rms speed of A that of B. **2**

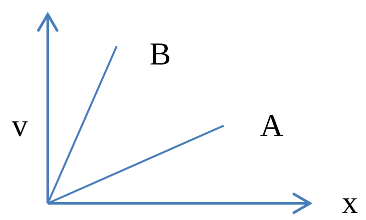
OR

An ideal gas is taken through a cyclic thermodynamic process in four steps. The amount of heat involved in these steps are; Q_1 = 5960J, Q_2 = - 5585J, Q_3 = - 2980J and Q_4 = 3645J respectively. The corresponding work involved are W_1 = 2200J, W_2 = - 825 J, W_3 = - 1100J and W_4 respectively. Calculate the value of W_4.

7 If the pressure at the bottom of a tank of water open to the atmosphere is double that at one – third depth of the water, calculate the pressure at the centre of the tank in terms of atmosphere pressure P. **2**

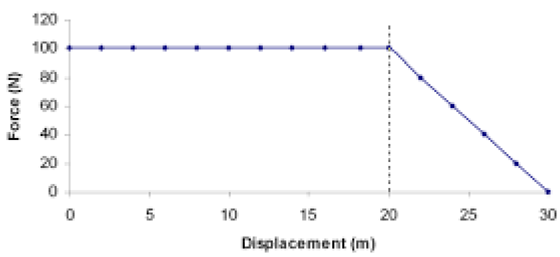
OR

Figure shows the velocity **v** verses the perpendicular distance **x** from the surface of contact with solid of two liquids A and B with same area for the layers. Identify the liquid having high viscosity if the corresponding layers experience same viscous force for both.
Give reason for your answer.



8 A body has an initial velocity 3 m/s and an acceleration of 1 m/s^2 normal to the direction of initial velocity. Calculate the magnitude of its velocity 4 seconds after the start. **2**

9 (i) Calculate the work done by the force from the given graph. **2**

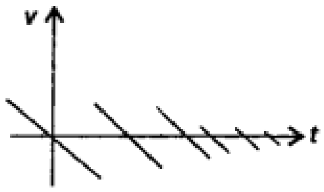


(ii) When a body travels from initial position x_0 = 5 m to x = 35 m, its potential energy changes by 90 J. Calculate the magnitude of conservative force acting on the body.

10 Derive the relation connecting the coefficient of linear expansion and the coefficient of volume expansion. **2**

11 (a) Can a body have zero velocity and still be accelerating? If yes, give any two situations. **2**

(b) Suggest a suitable physical situation for the following graph.



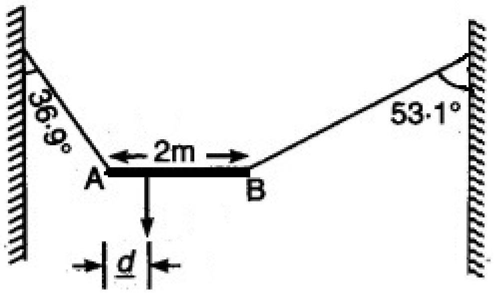
12 Draw the L – T^2 graph of the pendulum and explain how you calculate the length of a second's pendulum. **2**

SECTION C

13 On a 60 km straight road, a bus travels the first 30 km with a uniform speed of 30km/h. How fast must the bus travel the next 30 km so as to have an average speed of 40 km/h for the entire trip? **3**

14 The time period of oscillation of a liquid drop depends on the surface tension **S**, density of the liquid **ρ** and radius **r**. Derive an equation for the time period in terms of these quantities using the method of dimensions. **3**

15 A non-uniform bar of weight W is suspended at rest by two strings of negligible weights as shown in figure. The angles made by the strings with the vertical are 36.9° and 53.1° respectively. The bar is 2 m long. Calculate the distance d of the centre of gravity of the bar from its left end. **3**



16 (a)What are the characteristic properties of collisions obtained in the presence of only conservative forces? **3**

(b) What is the ratio of velocity of separation to velocity of approach in elastic collision one dimension?

(c) Draw the labelled diagram of such a collision in two dimensions.

OR

(a) A block of mass **m** moving at a speed **v** compresses a spring through a distance **x** when its speed is halved. Show that the spring constant of the spring, $\mathbf{k = 3mv^2 / 4x^2}$

(b)Draw the energy – time graph of the spring when it is released.

17 (a) Show that the second law is the real law of motion by obtaining the first and third laws from it. **3**

(b) What is the trajectory of the bob of a pendulum if the string is cut when the bob is (i) at one of is extreme positions and (ii) at its mean position.

18 Define terminal velocity and obtain the expression for the terminal velocity of a smooth sphere falling through a viscous medium. **3**

OR

Write the condition for the equilibrium of a convex liquid surface. Derive the equation for the excess pressure inside a liquid drop.

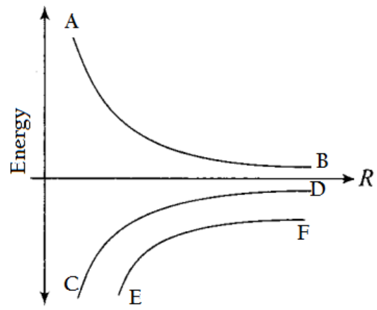
19 Draw the labelled diagram of an astronomical telescope at normal adjustment. Derive the equation for its magnifying power. Write any two advantages of reflecting telescope over refracting telescope. **3**

OR

Define total internal reflection. What are the conditions to obtain this phenomenon? Draw the diagrams of totally reflecting prisms to deviate the light by (a) 90^0 and (b) 180^0.

20 (a) Explain the variation of acceleration due to gravity due to the shape of earth. **3**

(b) The given graph is a plot between energy of an orbiting satellite and orbital radius R. Identify kinetic energy and total energy curves from the graph.

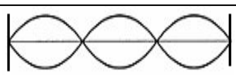
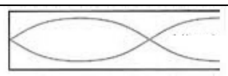


(c) An object travels from the centre of a spherical shell of uniform mass density and inner radius $\mathbf{r_1}$ and outer radius $\mathbf{r_2}$ to infinity. Draw the graph between distance and gravitational force. (Neglect the presence of other objects.)

21 State first law of thermodynamics. Hence derive the relation connecting the two specific heats of one mole of an ideal gas. **3**

22 Appling kinetic theory of gases, derive the equation for the pressure exerted by an ideal gas. **3**

23 Draw the given table in your answer book and fill the vacant boxes. **3**

Standing waves	Diagram of third harmonics	Number of nodes	Number of antinodes	The order of overtone
Stretched String		……………..	…………	II
Pipe closed at one end		……….	2	…………
Open pipe	……………..	3	4	……………

OR

With the help of necessary equation explain the following

(a) Before being played, string instruments are tuned by twisting a series of screws or pegs.

(b) Violinists and guitar players press their fingers against the string while playing.

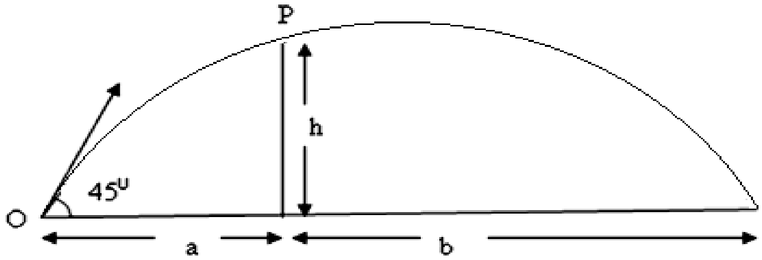
(c) In a piano, the strings that sound the high notes are much thinner than the strings that sound the low notes.

24 A body describes simple harmonic motion with amplitude of 5 cm and a period of 0.2 seconds. Find the acceleration and velocity of the body when the displacement is (a) 5cm, (b) 3 cm and (c) 0 cm. **3**

SECTION D

25 (a) Derive the equations for nature of path and maximum range of a projectile fired at an angle with horizontal. **5**

(b)



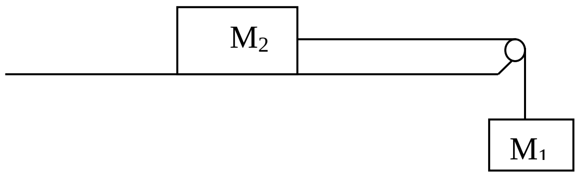
From a point on the ground at a distance ‘a’ from the foot of a pole of height ‘h’, a ball is thrown, at an angle of 45^0, which just touches the top of the pole and strikes the ground at a distance ‘b’, on the other side of it. Find the height of the pole as,

$$\mathbf{h = ab/ (a + b)}$$

OR

(a)With the help of a diagram, derive the equation for the maximum speed of a car on a banked road.

(b) In the given figure, if the role of friction is negligible, find the acceleration of the mass M_2.



26 (a)Derive the equation for the centre of mass of a two particles system. **5**

(b) From a uniform disc of radius R, a circular hole of radius R/2 is cut out. The centre of mass of the hole is at R/2 from the centre of the original disc. Locate the centre of mass of the resulting flat body.

OR

(a) What is escape velocity? Obtain an equation for it.

(b) Derive an expression for the orbital velocity of a satellite at a height h from the surface of earth. A rocket of mass **m** is fired vertically with a speed **v** from earth’s surface. It reaches the height **h** before returning to earth. Write the equation for the conservation of energy of the rocket when it is at the maximum height. [Take mass of the earth M and its radius R].

27 (i)Derive the expressions for the characteristics (displacement, velocity and acceleration) of SHM using uniform circular motion. **5**

(ii) Prove that the total energy remains constant for an oscillator and draw its energy – time graph.

OR

Draw an appropriate ray diagram to show the passage of a ray of light, incident on one of the two refracting faces of a prism. Deduce the equation for the refractive index of the prism and draw the graph between angle of incidence and angle of deviation. Derive the relation for the angle of deviation, for a prism of small refracting angle.