

# SHARJAH INDIAN SCHOOL, SHARJAH.

## Model Examination – February 2013

Class: XI (Boys Wing)

Max.Marks: 70

Subject: **PHYSICS**

Max.time: 3Hrs

**Day & Date: Sunday, 10.02.2013**

General Instructions:-

1. All questions are compulsory.

2. Question numbers 1 to 8 are very short answer questions, carrying 1 mark each. Questions 9 to 16 are short answer questions each carrying 2 marks. Questions 17 to 25 are also short answer questions each carrying 3 marks. Questions 26 is a value based question carrying 4 marks. Questions 27 to 29 are long answer questions each carrying 5 marks

3. There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the given choices in such questions.

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1. Can two astronauts talk on the surface of moon as they do on earth? Give reason for your answer.
  2. If the total energy with an oscillating system is E, what is the kinetic energy at  $x=A/3$ ?
  3. If the length and time period of an oscillating pendulum have errors 1% and 2% respectively, what is the error in the estimate of "g"?
  4. Nitrogen and Hydrogen are in thermal equilibrium. What is the ratio of kinetic energies of nitrogen molecule and hydrogen molecule when nitrogen is 14 times heavier than hydrogen?
  5. Under what conditions do real gases behave like ideal gas?
  6. Why do we prefer to use a wrench with a long arm?
  7. A body is initially at rest. It undergoes one dimensional motion with constant acceleration. The power delivered to it in time t is proportional to (i)  $t^{1/2}$  (ii) t (iii)  $t^{3/2}$  (iv)  $t^2$
  8. The Young's modulus of a wire of length L and radius r is Y. If the length is reduced to L/2 and radius r/2 what will be its Young's modulus?
  9. If  $A=12.0 \pm 0.1$  cm and  $B=(8.5 \pm 0.5)$  cm, find: (i) A+B (ii) A-B
  10. A motorboat covers the distance between two ports on the river in  $t_1=8$  hours and  $t_2=12$  hours downstream and upstream respectively. What is the time required for the boat to cover this distance in still water?
  11. State law of conservation of momentum. Use this law to explain the explosion of a mass at rest.
  12. A body of mass 10 kg is placed on an inclined surface of angle  $30^\circ$ . If the coefficient of limiting friction is  $1/\sqrt{3}$ , find the force required to just push the body up the inclined surface.
  13. A force  $3i+2j$  displaces a 1 kg mass from  $i+j$  to  $-i+2j$ . Find the work done.

OR

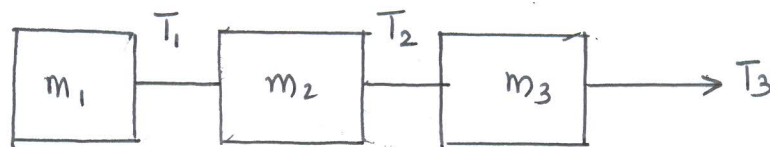
A force of  $F=(3x^2-2x+7)$  N displaces a particle along the x-axis from  $x=0$  to  $x=5$  m. Calculate the work done.

14. A disc of mass  $M$  and radius  $r$  is rotating with an angular velocity  $\omega$ . If gently, two masses  $m$  are placed at a distance  $r/2$  on either side of the axis what will be its angular velocity?
15. The change in the value of  $g$  at a height  $h$  above the earth is same as at a depth  $d$  below it. If  $h$  and  $d$  are small as compared to the radius of the earth, what is the ratio of  $h/d$ ?
16. Define and draw the P-V diagram for (i) isochoric process (ii) isobaric process
17. What is simple harmonic motion? Show that in S.H.M acceleration is directly proportional to its displacement at a given instant. Also find the expression for time period of a body in S.H.M.
18. Using law of equipartition of energy find the ratio of two specific heats for a diatomic gas.
19. The thermal efficiency of a heat engine is  $1/6$ . On reducing the temperature of the sink by  $63^\circ\text{C}$ , The efficiency doubles calculate the temperatures of the source and the sink of the engine.

OR

Write Kelvin-Planck and Clausius statements of second law of thermodynamics. Obtain an expression for the coefficient of performance of a heat pump.

20. State the Kepler's laws of planetary motion. If earth be at one half of its present distance from the sun, how many days will there be in a year?
21. Two particles of mass  $2\text{ kg}$  and  $1\text{ kg}$  are moving along the same line with speeds  $2\text{ m/s}$  and  $5\text{ m/s}$  respectively. What is the speed of the centre of mass of the system if both the particles are moving (a) in same direction (b) in opposite direction?
22. Show that in case of one dimensional elastic collision of two bodies, the relative velocity of separation after the collision is equal to the relative velocity of approach before the collision.
23. Explain why: (i) Passengers in a bus fall back as it accelerate. (ii) Wheels are made circular in automobiles. (iii) A stone breaks the window glass into pieces, while a bullet pierces through the same.
24. Three blocks are connected as shown on a horizontal frictionless table, and pulled to the right with a force of  $T_3=60\text{ N}$ . If  $m_1=10\text{ kg}$ ,  $m_2=20\text{ kg}$  and  $m_3=30\text{ kg}$ . Prove that  $T_1/T_2=1/3$ .



25. Define a unit vector. Determine a unit vector which is perpendicular to both  $\vec{A} = 2\hat{i} + \hat{j} + \hat{k}$  and  $\vec{B} = \hat{i} - \hat{j} + 2\hat{k}$ .
26. Having found his mother suffering from fever Venkat took her to the doctor for treatment. While checking the status, the doctor used a thermometer to know the temperature of the body. He kept the thermometer in the mouth of the patient and noted the reading as  $102^\circ\text{F}$ . Doctor gave the necessary medicines. After coming

home, Venkat asked his mother, who is a science teacher, why mercury is used in a thermometer when there are so many liquids. Then his mother explained the reason. (a) Comment upon the values of the mother. (b) Can you state the reasons for mercury being used as a thermometric liquid. (c) A newly designed thermometer has its lower fixed point and upper fixed point marked at  $5^{\circ}$  and  $95^{\circ}$  respectively. Compute the temperature on this scale corresponding to  $50^{\circ}\text{C}$ .

27. Draw velocity-time graph of uniformly accelerated motion in one-dimension. From the graph deduce the equation of motion in distance and time. A point object is thrown vertically upwards at such a speed that it returns to the thrower after 6 seconds. Find the distance travelled by it in the last second of its journey. (Take  $g = 9.8 \text{ m/s}^2$ )

O R

Define projectile. Show that the path of a projectile is a parabola. A fighter plane flying horizontally at an altitude of 1.5 km with speed 720 km/hr passes directly overhead an anti-aircraft gun. At what angle from the vertical should the gun be fired for the shell with muzzle speed 600 m/s to hit the plane? At what minimum altitude should the pilot fly the plane to avoid being hit? (Take  $g = 10 \text{ m/s}^2$ )

28. Define angle of contact of a liquid with a surface. On what factors does it depend? Derive an expression for the rise of a liquid in a capillary tube of uniform diameter.

O R

Explain why "A drop of liquid under no external force is always spherical in shape". Establish a relation for the excess pressure in a drop of liquid of surface tension  $T$ .

29. What are beats? Name the basic phenomenon due to which beats are produced. Two sources of sound are producing waves of frequency  $n_1$ , and  $n_2$ , where  $(n_1 - n_2)$  is small, show mathematically that the beat frequency is  $(n_1 - n_2)$ .

O R

Show that in an open organ pipe, all harmonics are present.

The third overtone of a closed pipe of length  $l_1$ , is found to be in unison with first overtone of an open pipe of length  $l_2$ . Find the ratio of the lengths of the pipes?