

GULF SAHODAYA (SAUDI CHAPTER) EXAMINATION -2011

GRADE: XI

Maximum marks: 70

Time: 3 hours

Total pages: 04

SUBJECT: PHYSICS

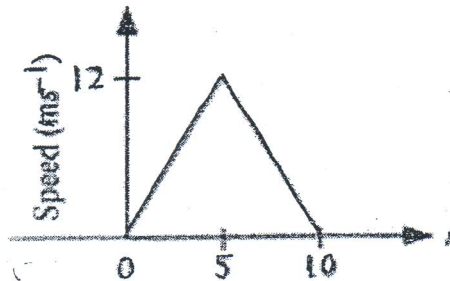
SET-A

General Instructions:

- (i) All questions are compulsory.
- (ii) There are 30 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 18 carry two marks each, questions 19 to 27 carry three marks each and questions 28 to 30 carry five marks each.
- (iii) 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.
- (iv) Use of calculators is not permitted. However you may use log table if necessary.

1. In the equation, $y = A \sin (\omega t - kx)$, obtain the dimensional formula of ' ω ' and ' k '. Given ' x ' is distance and ' t ' is time.
2. If oil of density higher than density of water is used in a resonance tube, how will the frequency change?
3. The escape velocity of a body projected vertically upwards from the surface of the earth is ' v '. What is the escape velocity, if the body is projected in a direction making an angle ' θ ' with the vertical?
4. Comets move around the sun in highly elliptical orbits. The gravitational force on the comet due to the sun is not normal to the comet's velocity in general. Yet the work done by the gravitational force over every complete orbit of the comet is zero. Why?
A child sits stationary at one end of a long trolley moving uniformly with a speed ' V ' on a smooth horizontal floor. If the child gets up and runs about on the trolley in any manner, what is the speed of the CM of the (trolley + child) system?
6. The displacement-time graph for the two particles 'A' and 'B' are straight lines inclined at angles of 30° and 45° with the time axis. What is the ratio of the velocities $v_A : v_B$?
7. A man with wrist watch on his hand falls from the top of the tower. Does the watch give correct time during the free fall? Give reason for your answer.
8. Two particles of equal mass move in a circle of radius ' r ' under the action of their mutual gravitational attraction. Find the speed of each particle if its mass is ' m '.
9. State parallelogram law of vector addition. Give the magnitude and direction of two vectors ' a ' and ' b ' making an angle ' θ ' between them.

10. The driver of a three-wheeler moving with a speed of 36km/h sees a child standing in the middle of the road and brings his vehicle to rest in 4s just in time to save the child. What is the average retarding force on the vehicle? The mass of the three-wheeler is 400kg and the mass of the driver is 65kg.
11. The speed-time graph of a particle moving along a fixed direction is shown in Figure. Obtain the distance traversed by the particle between $t = 0$ s to 10 s (b) what is the average speed of the particle over the interval?

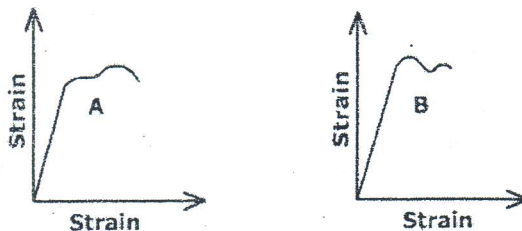


12. A grind stone has a moment of inertia 6kgm^2 . A constant torque is applied and the grindstone is found to have a speed of 150 rpm for 10s after starting from rest. Calculate the torque.
13. A physical quantity P is related to four observables 'a', 'b', 'c' and 'd' as follows: $P = \frac{a^2 b^3}{\sqrt{cd}}$. The percentage errors of measurement in a, b, c and d are 1%, 3%, 4% and 2%, respectively. What is the percentage error in the quantity P ?

OR

The velocity 'v' of water waves may depend on their wavelength (λ), density of water (ρ) and the acceleration due to gravity (g). Find relation between these quantities by the method of dimension?

14. The stress-strain graphs for material 'A' and 'B' are shown below in figure below. The graphs are drawn to the same scale. (a) Which of the material has greater Young's modulus? Why? (b) Which material is more ductile? Why?



15. What are reversible and non-reversible processes? Give one example for both.

- 16. A pump on the ground floor of a building can pump up water to fill a tank of volume 30m^3 in 15 minutes. If the tank is 40m above the ground, and the efficiency of the pump is 30%, how much electric power is consumed by the pump?
- 17. Explain why:
 - (a) A horse cannot pull a cart and run in empty space.
 - (b) Passengers are thrown forward from their seats when a speeding bus stops suddenly.
- 18. At what temperature is the root mean square speed of an atom in argon gas cylinder equal to the r.m.s speed of a helium gas atom at -20°C ? *Imp.*
(Atomic mass of Argon= 39.9u , Atomic mass of Helium= 4u)
- 19. A stone is dropped from a height 'h'. Prove that the total mechanical energy at any point in its path is 'mgh'.
- 20. (a)What is meant by banking of roads?
(b) A train runs along an unbanked circular track of radius 30 m at a speed of 54 km/h. The mass of the train is 10^6 kg. What provides the centripetal force required for this purpose – The engine or the rails? What is the angle of banking required to prevent wearing out of the rail?
- 21. State and prove law of conservation of linear momentum using Newton's third law of motion.
- 22. (A)(i)Define orbital velocity.
(ii)Derive an expression for orbital velocity of an artificial satellite of mass 'm' moving in a circular orbit at a height 'h' above from the earth's surface.

OR

- (B)(i) Define Gravitational potential energy.
(ii) Deduce an expression for gravitational potential energy of a body placed at a point near the surface of earth?
- 23. (i)What is meant by capillarity?
(ii) Derive an expression for the rise of liquid in a capillary tube.
- 24. (i) Define coefficient of performance of a refrigerator.
(ii) A refrigerator is to maintain eatables kept inside at 9°C . If room temperature is 36°C , calculate the coefficient of performance
- 25. (i)What do you understand by centre of mass of a system?
(ii)Derive an expression for position vector of centre of mass of a system of two particles.
- 26. A wire stretched between two rigid supports vibrates in its fundamental mode with a frequency of 45 Hz. The mass of the wire is 3.5×10^{-2} kg and its linear mass density is 4.0×10^{-2} kg m^{-1} . What is (a) the speed of a transverse wave on the string, and (b) the tension in the string?
- 27. (i)Define r.m.s velocity of the molecules of the gas.
(ii)How is temperature related to average kinetic energy of the molecule of the gas?

28. (A) What are beats? How are they formed? Derive an expression for beat period and beat frequency.

OR

(B) What is meant by simple harmonic motion? Show that the motion of the pendulum is simple harmonic and hence deduce an expression for the time period of pendulum. Also define second's pendulum.

29. (A) (i) Draw velocity - time graph of uniformly accelerated motion. By using this graph deduce all three equations of motion.

(ii) A police van moving on a highway with a speed of 30 km h^{-1} fires a bullet at a thief's car speeding away in the same direction with a speed of 192 km h^{-1} . If the muzzle speed of the bullet is 150 m s^{-1} , with what speed does the bullet hit the thief's car? (Obtain that speed which is relevant for damaging the thief's car).

OR

(B) A projectile is fired at an angle ' θ ' with the horizontal. (a) Show that its trajectory is a parabola. (b) Obtain expression for maximum height (ii) the time of flight and (iii) the horizontal range.

30. (A) (a) State the principle on which hydraulic lift work and explain its working?

(b) In a car lift, compressed air exerts a force F_1 on a small piston having a radius of 5cm. This pressure is transmitted to a second piston of radius 10.0cm. If the mass of the car to be lifted is 1350kg, calculate F_1 . What is the pressure necessary to accomplish this task?

OR

(B) (a) Define surface tension. Prove that surface tension is numerically equal to surface energy.

(b) A square wire frame of side 10cm is dipped in a liquid of surface tension $28 \times 10^{-3} \text{ Nm}^{-1}$. On taking out, membrane is formed. What is the force acting on the surface of wire frame?
