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Code Number:42



INDIAN SCHOOL MUSCAT
FINAL TERM EXAMINATION
PHYSICS

CLASS: XI
28.02.2018

Sub. Code: 042

Time Allotted: 3 hrs
Max. Marks: 70

General instructions

1. All questions are compulsory. There are 26 questions in all.
2. This question paper has five sections: section A, section B, section C, section D and section E.
3. Section A contains five questions of one mark each, Section B contains five questions of two marks each, Section C contains twelve questions of three marks each, Section D contains one value based question of four marks and Section E contains three questions of five marks each.
4. There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and in all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
5. You may use the following value of physical constant wherever necessary: $g = 9.8 \text{ m/s}^2$.

SECTION A

1. Give any two differences between gravitational force and electromagnetic force. 1
2. Two artificial satellites, one close to the surface of the earth and the other revolving at greater height around the earth, which of them has larger speed? 1
3. Why the pendulum of a clock is made up of invar? 1
4. Why the efficiency of heat engine can't be 100% or unity? 1
5. Define degrees of freedom for an ideal gas. 1

SECTION B

6. What is random error? State the ways to minimise it. 2
7. a) Carts with rubber tyres are easier to ply than those with iron wheels. Why? (1 mark) 2
b) Can a bomb initially at rest explode into three pieces which fly in mutually perpendicular direction. Justify? (1 mark)
8. If the radius of earth becomes two times the present value and its mass remains unchanged, then how would the weight of an object on the surface of the earth would be affected? 2

9. a) Why are springs made of steel and not of copper? (1 mark) 2
 b) Which physical quantity is represented by the area under stress-strain graph? (1 mark)
10. Derive the differential equation for simple harmonic motion. 2

SECTION C

11. a) Draw velocity-time graph for an object thrown vertically upwards returning to the point of projection. (1 mark) 3
 b) Can a distance- time graph of an object be parallel to time axis? Give reason. (1 mark)
 c) Can an object's velocity change direction when its acceleration is constant? Support your answer with an example. (1 mark)
12. a) State parallelogram law of vector addition. (1 mark) 3
 b) Prove that commutative law of addition holds good for vectors. (2 marks)
13. a) The sparks coming from the grind stone fly off tangentially. Give reason. (1 mark) 3
 b) A cricket player lower his hands to catch the ball safely. Explain why? (1 mark)
 c) A lift is going up with an acceleration $3g$. A man is inside the lift and his mass is m . What will be the apparent weight of the man? (1 mark)
14. State and verify work-energy theorem for constant force. (3 marks) 3

OR

- a) State any two differences between conservative and non-conservative forces. (1 mark)
 b) Derive the expression for the potential energy stored in a spring-block system. (2 marks)
15. a) Verify law of conservation of energy for a freely falling object. (2 marks) 3
 b) Plot the graph showing variation of kinetic energy and potential energy for the object under free fall. (1 mark)
16. a) Why do we prefer to use a wrench of longer arm? (1 mark) 3
 b) How does a ballet dancer vary her angular speed by outstretching her arms and legs? (2 marks)
17. a) State perpendicular axes theorem. (1 mark) 3
 b) Torques of equal magnitude are applied to a hollow cylinder and a solid sphere both having the same mass and radius and initially at rest. The cylinder is free to rotate about its axis of symmetry, and the sphere is free to rotate about an axis passing through its centre. Which of the two will acquire greater angular speed in the same interval of time? Explain. (2 marks)
18. State and prove the law of periods of planetary motion. 3
19. a) Why water is used as a coolant in automobiles? (1 mark) 3
 b) In a thermos flask, how heat loss by radiation is minimised? (1 mark)

- c) Why do birds swell their feathers in winter? (1 mark)
20. Derive the relation between the molar specific heat capacities of a gas under constant pressure and under constant volume. (3 marks) 3
21. State law of equipartition of energy. Using this law calculate the ratio of molar specific heat capacities of a mono atomic gas. 3
22. A transverse harmonic wave on a wire is expressed as: 3
- $$y(x, t) = 3 \sin (36t + 0.018x + \pi/4),$$
- where x and y are in cm and t in seconds
- a) Is it a stationary wave or a travelling wave? (½mark)
- b) Find its frequency and amplitude of the wave. (1 ½ marks)
- c) Calculate the least distance between two adjacent crests in the wave? (1)

SECTION D

23. Having seen a big stone falling from the top of a tower, Raju pulled his friend Kiran away. He saved his friend from a major accident. 4
- a) What are the values shown by Raju? (2 marks)
- b) A stone is allowed to fall from the top of a tower 100 m high and at the same time another stone is projected vertically upwards from the ground with a velocity of 25 m/s. Calculate when and where the two stones will meet. (2 marks)

SECTION E

24. a) State and verify law of conservation of linear momentum (3 marks).
- b) A bullet of mass 0.04 kg moving with a speed of 90 m/s enters a heavy wooden block and is stopped after a distance of 60 cm. What is the average resistive force exerted by the block on the bullet? (2 marks)

OR

- a) Derive Newton's first and third law of motion from second law of motion. (3 marks)
- b) Two billiard balls each of mass 0.05 kg moving in opposite directions with a speed of 6 m/s collide and rebound with the same speed. What is the impulse imparted to each ball due to the other? (2 marks) 5
25. a) State and prove Bernoulli's principle. (3 marks) 5
- b) In a test experiment on a model aeroplane on a wind tunnel, the flow speeds on the upper and lower surfaces of the wing are 70 m/s and 63 m/s respectively. What is the lift on the wing if its area is 2.5 m^2 ? Take the density of air to be 1.3 kgm^{-3} . (2 marks)

OR

- a) Define terminal velocity. Derive an expression for the terminal velocity attained by a spherical body falling through a viscous medium. (3 marks)
- b) A rain drop of radius 0.2 mm has a terminal velocity in air 2 m/s. The viscosity of air is $18 \times 10^{-5} \text{ Nm}^{-2}\text{s}$. Find the viscous force on the rain drop. (2 marks)

26. a) Show that the oscillations of a simple pendulum are simple harmonic and derive the expression for time period of the simple pendulum. (3 marks) 5
- b) Why soldiers are asked not to march over old bridges. (1 mark)
- c) Draw a graph showing the variation of energy with respect to time for a harmonic oscillator executing damped oscillations. (1 mark)

OR

- a) Discuss about the harmonics formed in an open organ pipe and show that the frequencies of the harmonics are in the ratio 1:2:3. (3 marks)
- b) Give two differences between stationary wave and progressive wave. (1 mark)
- c) Why does sound travel faster on a rainy day than on a dry day? (1 mark)

End of the Question Paper