

No. of Printed Pages : 4

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PART – III, aw:gpai; / **PHYSICS**

(English Version)

Time Allowed : 3.00 Hours]

[Maximum Marks : 70

- Instructions :**
- (1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.
 - (2) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

PART – I

- Note :**
- (i) Answer **all** the questions. **15x1=15**
 - (ii) Choose the most appropriate answer from the given **four** alternatives and write the option code and the corresponding answer.

- What is the angular displacement made by a particle after 5s, when it starts from rest with an angular acceleration 0.2 rad s^{-2} ?
 (a) 4 rad (b) 1 rad (c) 2.5 rad (d) 5 rad
- The process in which heat transfer is by actual movement of molecules in fluids such as liquids and gases is called:
 (a) thermal conductivity (b) Convection
 (c) Conduction (d) Radiation
- Which of the following pairs of physical quantities have the same dimensions?
 (a) Torque and Power (b) Force and torque
 (c) Force and Power (d) Torque and Energy
- For a satellite moving in an orbit around the earth, the ratio of kinetic energy to potential energy is :
 (a) 2 (b) $\sqrt{2}$ (c) $\frac{1}{2}$ (d) $\frac{1}{\sqrt{2}}$
- There is a small bubble at one end and bigger bubble at other end of a pipe. Which among the following will happen?



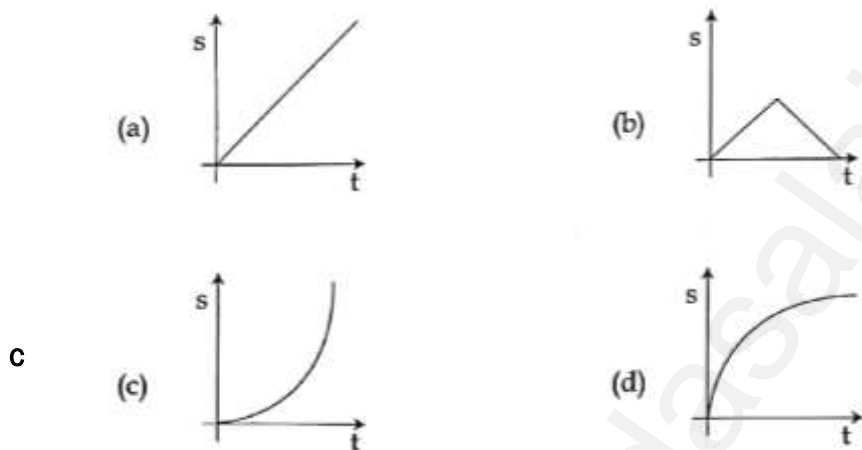
- (a) remains in equilibrium (b) smaller will grow until they collapse
 (c) bigger will grow until they collapse (d) none of the above
- A refrigerator has COP of 3. How much work must be supplied to a refrigerator in order to remove 200 J of heat from its interior?
 (a) 33.33 J (b) 44.44 J (c) 66.67 J (d) 50 J

[Turn Over

M2019

2

7. If the temperature of the wire is increased, then the Young's Modulus will:
 (a) increase rapidly (b) increase by very small amount
 (c) remain the same (d) decrease
8. If the internal energy of an ideal gas U and volume V are doubled, then the pressure of the gas :
 (a) halves (b) quadruples (c) doubles (d) remains same
9. A body of mass 5 kg is thrown up vertically with a kinetic energy of 1000 J. If acceleration due to gravity is 10 ms^{-2} , find the height at which the kinetic energy becomes half of the original value.
 (a) 10 m (b) 20 m (c) 50 m (d) 100 m
10. Which graph represents uniform acceleration?



11. In an isochoric process, find which is relevant among the following:
 (a) $\Delta U = 0$ (b) $\Delta T = 0$ (c) $W = 0$ (d) $Q = 0$
12. The amplitude and time period of a simple pendulum bob are 0.05 m and 2 s respectively. Then the maximum velocity of the bob is :
 (a) 0.157 ms^{-1} (b) 0.257 ms^{-1} (c) 0.10 ms^{-1} (d) 0.025 ms^{-1}
13. A closed cylindrical container is partially filled with water. As the container rotates in a horizontal plane about a perpendicular bisector, its moment of inertia:
 (a) remains constant (b) depends on the direction of rotation
 (c) increase (d) decrease
14. Which of the following represents a wave?
 (a) $\frac{1}{x+vt}$ (b) $\sin(x+vt)$ (c) $(x-vt)^3$ (d) $x(x+vt)$
15. If the linear momentum of the object is increased by 0.1 %, then the kinetic energy is increased by:
 (a) 0.4 % (b) 0.01 % (c) 0.1 % (d) 0.2 %

PART – II

Note : Answer **any six** questions. Question No. **24** is **compulsory**.

6x2=12

16. Write any two errors of systematic errors. Explain them.
17. What is projectile? Give two examples.
18. State Newton's Second Law of Motion.
19. A car takes a turn with the velocity 50 ms^{-1} on a circular road of radius of curvature 10 m. Calculate the centrifugal force experienced by a person of mass 60 kg inside the car.
20. Why is it more difficult to revolve a stone tied to a longer string than a stone tied to a shorter string?
21. State Stefan – Boltzmann Law and write its expression.
22. List the factors affecting Brownian motion.
23. "Soldiers are not allowed to march on a bridge." Give reason.
24. The surface tension of a soap solution is 0.03 Nm^{-1} . How much work is done in producing soap bubble of radius 0.05 m?

PART – III

Note : Answer **any six** questions. Question No. **33** is **compulsory**.

6x3=18

25. What is the torque of the force $\vec{F} = 3\hat{i} - 2\hat{j} + 4\hat{k}$ acting at a point $\vec{r} = 2\hat{i} + 3\hat{j} + 5\hat{k}$ about the origin?
26. What are the various of friction? Suggest few methods to reduce friction.
27. A heavy body and a light body have same momentum. Which one of them has more kinetic energy and why?
28. Find the rotational kinetic energy of a ring of mass 9 kg and radius 3m rotating with 240 rpm about an axis passing through its centre and perpendicular to its plane.
29. What do you mean by the term weightlessness? Explain the state of weightlessness of a freely falling body.
30. Derive an expression for the terminal velocity of a sphere falling through a viscous liquid.
31. Explain linear expansion of solid.
32. Write down any six postulates of kinetic theory of gases.
33. Two waves of wavelength 99 cm and 100 cm both travelling with the velocity of 396 ms^{-1} are made to interfere. Calculate the number of beats produced by them per sec.

[Turn Over

M2019

4

PART - IV

Note : Answer **all** the questions.

5x5=25

34. (a) Explain the principle of homogeneity of dimensions and derive an expression for the force F acting on a body moving in a circular path depending on the mass of the body (m), velocity (v) and radius R of the circular path. Obtain the expression for the force by the dimensional analysis method (take the value $k = 1$).

(OR)

- (b) State and prove Bernoulli's Theorem for a flow of incompressible, non-viscous and streamlined flow of liquid.
35. (a) Prove the law of conservation of momentum. Use it to find the recoil velocity of a gun when a bullet is fired from it.

(OR)

- (b) State and prove parallel axes theorem.
36. (a) What is elastic collision? Derive an expression for final velocities of two bodies which undergo elastic collision in one dimension.

(OR)

- (b) How will you determine the velocity of sound using resonance air column apparatus?
37. (a) Derive the Mayer's relation for an ideal gas.

(OR)

- (b) Explain the horizontal oscillations of a spring.
38. (a) (i) Write down the equation of a freely falling body under gravity.
(ii) A ball is thrown vertically upwards with the speed of 19.6 ms^{-1} from the top of a building and reaches the earth in 6 s. Find the height of the building.

(OR)

- (b) (i) Define orbital velocity and establish an expression for it.
(ii) Calculate the value of orbital velocity for an artificial satellite of earth orbiting at a height of 1000 km (Mass of the earth = 6×10^{24} kg, radius of the earth = 6400 km).

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