Reg. No. : .....

124

Name : .....

FIRST YEAR HIGHER SECONDARY MODEL EXAMINATION, FEBRUARY 2024

Part – III

PHYSICS

Maximum : 60 Scores

Time : 2 Hours

Cool-off Time : 15 Minutes

General Instructions to Candidates :

- *There is a 'Cool off time' of 15 minutes in addition to the writing time.*
- *Use 'cool off time' to get familiar with questions and to plan your answers.*
- *Read questions carefully before answering.*
- *Calculations, figures and graphs should be shown in the answer sheet itself.*
- *Malayalam version of the questions is also provided.*
- *Give equations wherever necessary.*
- *Electronic devices except non programmable calculators are not allowed in the Examination Hall.*

വിദ്യാർത്ഥികൾക്കുള്ള പൊതുനിർദ്ദേശങ്ങൾ :

- നിർദ്ദിഷ്ട സമയത്തിന് പുറമെ 15 മിനിട്ട് 'കൂൾ ഓഫ് ടൈം' ഉണ്ടായിരിക്കും.
- 'കൂൾ ഓഫ് ടൈം' ചോദ്യങ്ങൾ പരിചയപ്പെടാനും ഉത്തരങ്ങൾ ആസൂത്രണം ചെയ്യാനും ഉപയോഗിക്കുക.
- ഉത്തരങ്ങൾ എഴുതുന്നതിന് മുമ്പ് ചോദ്യങ്ങൾ ശ്രദ്ധാപൂർവ്വം വായിക്കണം.
- കണക്ക് കൂട്ടലുകൾ, ചിത്രങ്ങൾ, ഗ്രാഫുകൾ, എന്നിവ ഉത്തരപേപ്പറിൽ തന്നെ ഉണ്ടായിരിക്കണം.
- ചോദ്യങ്ങൾ മലയാളത്തിലും നൽകിയിട്ടുണ്ട്.
- ആവശ്യമുള്ള സ്ഥലത്ത് സമവാക്യങ്ങൾ കൊടുക്കണം.
- പ്രോഗ്രാമുകൾ ചെയ്യാനാകാത്ത കാൽക്കുലേറ്ററുകൾ ഒഴികെയുള്ള ഒരു ഇലക്ട്രോണിക് ഉപകരണവും പരീക്ഷാഹാളിൽ ഉപയോഗിക്കുവാൻ പാടില്ല.

Score

Answer any 5 questions from 1 to 7. Each carries 1 score. **(5×1=5)**

1. The dimensional formula for a physical quantity is $M L^2 T^{-2}$. Pick out the correct physical quantity.

   a) Force

   b) Momentum

   c) Work

   d) Power

2. The speedometer of a car shows 70 km/h. This represents

   a) Average velocity

   b) Instantaneous speed

   c) Average speed

   d) Instantaneous velocity

3. Choose the correct alternative

   The value of acceleration due to gravity g will be maximum at _____ (Poles/equator)

4. The ratio of longitudinal stress to longitudinal strain is _____

   a) Young modulus

   b) Bulk modulus

   c) Poisson's ratio

Score

5. Surface tension is numerically equal to

   a) Surface energy

   b) Potential energy

   c) Kinetic energy

   d) Thermal energy

6. The change of solid state to vapour state without passing through the liquid state is called _____

7. The average kinetic energy of a molecule of a gas is directly proportional to _____

Answer any 5 questions from 8 to 14. Each carries 2 scores. **(5×2=10)**

8. The positions of a body at different instances of time are given in the table. Draw the position-time graph and determine the velocity.

Position (Metre)	0	2	4	6
Time (Second)	0	1	2	3

9. Two forces 10N and 8N are acting at a point. The angle between them is 60°. Find the magnitude of the resultant force.

10. a) Classify the following into conservative and non-conservative forces : Electrostatic force, frictional force, magnetic force, viscous force. **(1)**

    b) Power = Force × _____ **(1)**

Score

11. a) Define moment of inertia of a body. (1)

b) Which physical quantity is represented by the product of moment of inertia and angular velocity ? (1)

12. a) State whether the velocity of escape for two bodies of masses 2 kg and 200 kg are same or different. Give reason. (1)

b) State Kepler's first law of planetary motion. (1)

13. What happens to the internal energy of a gas during

a) Isothermal expansion (1)

b) Adiabatic expansion (1)

14. Calculate the root mean square velocity of a gas at 300K.

(Molecular mass = 0.032 kg and R = 8.3 J mol^{-1} K^{-1})

Answer any 6 questions from 15 to 21. Each carries 3 scores. **(6×3=18)**

15. Derive the following equations for uniformly accelerated motion.

a) $x = v_0 t + \frac{1}{2} at^2$

b) $v^2 = v_0^2 + 2ax$

where x – displacement, v_0 – initial velocity, v – final velocity, a – acceleration and t – time.

16. a) State the law of conservation of momentum. (1)

b) Prove the law of conservation of momentum using Newton's third law of motion. (2)

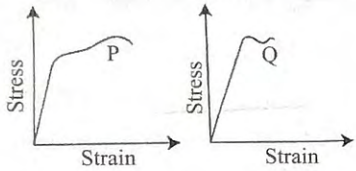
Score

17. a) The rotational analogue of mass in linear motion is _____ (1)

b) Angular momentum of a rotating body is $\vec{L} = \vec{r} \times \vec{p}$. Using this relation arrive at the equation $\frac{d\vec{L}}{dt} = \vec{\tau}$. (2)

18. Elasticity is the internal property of matter.

The stress – strain graph for materials P and Q are shown below.



a) What does the slope of stress - strain graph represent ? (1)

b) Which of the materials has the greater Young's modulus ? (1)

c) Which of the two is the stronger material ? Why ? (1)

19. Rain drops are being accelerated while falling through the atmosphere. But they reach the surface of earth with a constant velocity.

a) What is the name given to this velocity ? (1)

b) Derive an expression for the constant velocity attained by the rain drop. (2)

20. a) What do you mean by mean free path of a gas molecule ? (1)

b) State any two postulates of kinetic theory of gases. (2)

Score

21. a) State first law of thermodynamics. (1)

b) Draw the P-V diagram of Carnot engine and mark the different thermodynamic processes. (2)

Answer any 3 questions from 22 to 25. Each carries 4 scores. (3×4=12)

22. a) Write the number of significant figures of the following :

i) 0.0072

ii) 1.6×10^{-19} (1)

b) Check whether the equation $\left(\frac{1}{2}\right)mv^2 = mgh$ is dimensionally correct by the method of dimensions. Here, m – mass of the body, v – its velocity, h – the height and g – acceleration due to gravity. (3)

23. a) Check whether the work done in each of the following cases is zero, positive or negative

i) Work done by the gravitational force on a freely falling object. (1)

ii) Work done by friction. (1)

b) A stone is dropped from the top of a tower of height h. Draw the graph showing the variation of P.E. and K.E. with height of the stone. (2)

Score

24. a) Define simple harmonic motion. (1)

b) Show that oscillations of a pendulum represents simple harmonic motion. (2)

c) Where do the potential energy and kinetic energy of the simple pendulum become maximum ? (1)

25. a) Travelling wave along a string is described by $y(x, t) = 0.005 \sin (80.0x - 3.0t)$, where all parameters are in S.I. units. Calculate its wavelength and time period. (2)

b) Show that in the case of a closed pipe the frequency of the first two harmonics are in the ratio 1 : 3. (2)

Answer any 3 questions from 26 to 29. Each carries 5 scores. (3×5=15)

26. An object is projected with velocity u at an angle θ with the horizontal

a) Derive and equation for time of flight and horizontal range. (3)

b) Find the angle of projection for which the maximum height is equal to one fourth the horizontal range. (2)

Score

27. A vehicle of mass m moving with a velocity v along a banked road with radius r.

a) Draw the diagram showing various forces acting on it. (2)

b) Derive an expression for maximum permissible speed at the banked road with friction. (3)

28. a) State Newton's law of gravitation. (1)

b) Why does earth impart same acceleration on all bodies ? (1)

c) Derive an expression for the variation of acceleration due to gravity with height (h) above the surface of earth. (3)

29. a) State and prove Bernoulli's principle for the flow of non viscous fluid. (4)

b) Define coefficient of viscosity. (1)