

Reg. No. : .....

**FME-24**

Name : .....

**FIRST YEAR HIGHER SECONDARY  
MODEL EXAMINATION, FEBRUARY 2020**

Part – III

Time : 2 Hours

**PHYSICS**

Cool-off time : 15 Minutes

Maximum : 60 Scores

**General Instructions to Candidates :**

- There is a 'Cool-off time' of 15 minutes in addition to the writing time.
- Use the 'Cool-off time' to get familiar with questions and to plan your answers.
- Read questions carefully before answering.
- Read the instructions carefully.
- 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 മിനിറ്റ് 'കൂൾ ഓഫ് ടൈം' ഉണ്ടായിരിക്കും.
- 'കൂൾ ഓഫ് ടൈം' ചോദ്യങ്ങൾ പരിചയപ്പെടാനും ഉത്തരങ്ങൾ ആസൂത്രണം ചെയ്യാനും ഉപയോഗിക്കുക.
- ഉത്തരങ്ങൾ എഴുതുന്നതിന് മുമ്പ് ചോദ്യങ്ങൾ ശ്രദ്ധാപൂർവ്വം വായിക്കണം.
- നിർദ്ദേശങ്ങൾ മുഴുവനും ശ്രദ്ധാപൂർവ്വം വായിക്കണം.
- കണക്ക് കൂട്ടലുകൾ, ചിത്രങ്ങൾ, ഗ്രാഫുകൾ, എന്നിവ ഉത്തരപേപ്പറിൽ തന്നെ ഉണ്ടായിരിക്കണം.
- ചോദ്യങ്ങൾ മലയാളത്തിലും നല്കിയിട്ടുണ്ട്.
- ആവശ്യമുള്ള സ്ഥലത്ത് സമവാക്യങ്ങൾ കൊടുക്കണം.
- പ്രോഗ്രാമുകൾ ചെയ്യാനാകാത്ത കാൽക്കുലേറ്ററുകൾ ഒഴികെയുള്ള ഒരു ഇലക്ട്രോണിക് ഉപകരണവും പരീക്ഷാഹാളിൽ ഉപയോഗിക്കുവാൻ പാടില്ല.

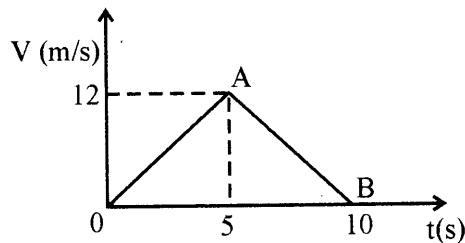
Question numbers 1 to 5 carry 1 score each. Answer any 3 questions. (3 × 1 = 3)

1. Which one of the following forces has shortest range of operation ?  
 (a) Gravitational force (b) Nuclear force  
 (c) Electrostatic force (d) Magnetic force
2. In the uniform circular motion, which of the following physical quantities **does not** remain constant ?  
 (a) Speed (b) Linear momentum  
 (c) Kinetic energy (d) Angular velocity
3. kilowatt hour is the unit of  
 (a) Energy (b) Power  
 (c) Time (d) Mass
4. Bernoulli's theorem is based on \_\_\_\_\_.
5. Write Mayer's relation connecting specific heat capacity and universal gas constant.

Question numbers 6 to 15 carry 2 score each. Answer any 8 questions. (8 × 2 = 16)

6. (a) Find the relative error in Z, if  

$$Z = \frac{A^4 B^{1/3}}{CD^{3/2}}$$
 1  
 (b) Find the number of significant figures in the following :  
 (1) 0.042 (2) 42.000 1
7. The speed-time graph for a particle moving along a fixed direction is shown in figure below. Calculate the distance travelled by the particle between t = 0 to t = 10s. 2



8. (a) State laws of static friction. 1  
 (b) Rolling friction is less than sliding friction. Why ? 1

9. (a) The process of change of state from liquid to solid is called \_\_\_\_\_. 1
- (b) Define latent heat. 1
10. (a) The r.m.s. velocity of a perfect gas is
- (i)  $u = \sqrt{3RTM}$  (ii)  $u = \sqrt{\frac{3RT}{M}}$
- (iii)  $u = \sqrt{\frac{RT}{3M}}$  (iv)  $u = \sqrt{\frac{3M}{RT}}$  1
- (b) Calculate the r.m.s velocity of oxygen at a temperature of 100 °C.  
(Molar mass of oxygen = 32 g and R = 8.31 J mole<sup>-1</sup> K<sup>-1</sup>) 1
11. (a) State the law of conservation of angular momentum. 1
- (b) If a particle moves in a circular path with decreasing speed, how its angular momentum changes? 1
12. Consider a spring applied with a force within the elastic limit.
- (a) Draw the variation of restoring force F with displacement X from the mean position. 1
- (b) What does the area of the graph represent? 1
13. (a) State first law of thermodynamics. 1
- (b) An electric heater supplies heat to a system at a rate of 100 J/s. If the system performs work at a rate of 75 J/s, calculate the internal energy increased. 1
14. A particle executes SHM of amplitude 'a',
- (i) at what distance from the mean position is its kinetic energy equal to potential energy? 1
- (ii) at which point is its speed half the maximum speed? 1
15. Heat engine is a device which converts heat energy into mechanical energy.
- (a) Name the processes in a Carnot's cycle. 1
- (b) Can you design an engine of 100% efficiency? Justify your answer. 1

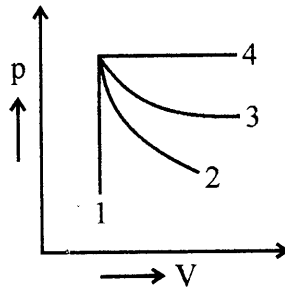
Question numbers 16 to 23 carry 3 score each. Answer any 5 questions (5 × 3 = 15)

16. "There are certain physical quantities having no dimensions but still having units."  
 (a) State whether the statement is true or false. Justify your answer with an example. 1  
 (b) Check the correctness of the equation  $v^2 = v_0^2 + 2ax$  using dimensional analysis. 2
17. (a) Substances which can be stretched to great extent with a small stress is called \_\_\_\_\_ 1  
 (b) Bulk modulus of water is  $2 \times 10^9 \text{ Nm}^{-2}$ . Find its compressibility. 1  
 (c) Steel or rubber, which is more elastic ? Explain. 1
18. (a) Obtain an expression for orbital velocity of a satellite at a height  $h$  from the surface of earth. 2  
 (b) The orbital velocity of a satellite of mass  $m$  is  $V_0$ . What will be the orbital velocity of another satellite of mass  $2m$  in the same orbit ? 1
19. (a) Under what condition will the equality :  $|\vec{A} \times \vec{B}| = \vec{A} \cdot \vec{B}$  hold good ? 1  
 (b) Two forces 5 N and 7 N are acting at a point. The angle between them is  $60^\circ$ . Find the resultant force. 2
20. "Every SHM is periodic motion but every periodic motion need not be SHM."  
 (a) State whether the statement is true or false. Justify your answer with an example. 1  
 (b) What do you mean by seconds pendulum ? 1  
 (c) What will be the period of oscillation, if the length of a seconds pendulum is halved ? 1
21. (a) Can a body possess zero velocity and still accelerate ? Explain with a suitable example. 1  
 (b) A boy takes 5 minutes to ride a cycle on a horizontal circular track of radius 2 km. What is the distance, displacement, average speed of the boy in the following cases ?  
 (i) He reaches back to the starting point. 1  
 (ii) As he is at the diametrically opposite point on the track. 1
22. (a) State Pascal's law. 1  
 (b) Calculate the pressure on a swimmer 10 m below the surface of a lake. 2

23. A stone of mass  $m$  is projected with a velocity  $u$  at an angle  $\theta$  with the horizontal.
- (a) Derive an expression for time of flight of the stone. 2
- (b) Calculate the value of kinetic energy of the particle at the highest point. 1

**Answer all questions from 24 to 27. Each carry 4 scores. (4 × 4 = 16)**

24. (a) P – V diagram of an ideal gas undergoes four different processes as shown in figure below. These processes are isothermal, adiabatic, isobaric and isochoric.

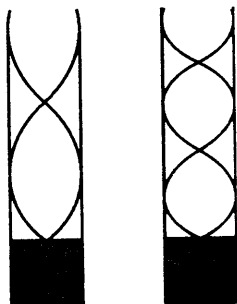


- (i) Which diagram shows adiabatic process? 1
- (ii) In which of these processes the work done is maximum? 1
- (b) One mole of an ideal gas expands from volume  $V_1$  to volume  $V_2$  at constant temperature  $T$ . Derive an expression for the work done. 2
25. The value of acceleration due to gravity ( $g$ ) is same for all objects at a given place.
- (a) Does a body have the same weight at the equator and at the poles? Explain. 1
- (b) At what height above Earth's surface the value of ' $g$ ' is same as in a mine 80 km deep? 2
- (c) Draw a graph showing the variation of magnitude of the value of acceleration due to gravity ( $g$ ) with distance from the centre of the earth. 1
26. A stone is dropped from the top of tower of height  $h$ .
- (a) State work – energy theorem. 1
- (b) Prove law of conservation of energy in this case. 2
- (c) Draw the variation of P.E. and K.E. with the height of the stone. 1

27. Moment of inertia of a body is a measure of its rotational inertia.
- (a) What are the factors on which moment of inertia of a rigid body depends? 1
- (b) State the theorem that helps to find the moment of inertia of a disc about any diameter. 1
- (c) A disc and a ring of same outer radii have the same mass. Which will have the larger moment of inertia about an axis passing through the centre and perpendicular to the planes? 2

**Answer any two questions from 28 to 30. Each carry 5 scores. (2 × 5 = 10)**

28. A cyclist speeding at 18 km/hr on a level road takes a sharp turn without reducing the speed. (Radius of the circular path = 3m)
- (a) Centripetal force is provided by \_\_\_\_\_. 1
- (b) Derive an expression for safe speed of the cyclist at the turning. 2
- (c) If the coefficient of friction between the tyre and the road is 0.10, will the cyclist slip while taking the turn? 2
29. The air column inside the pipe can vibrate in different modes as shown in figure.
- (a) Identify the different modes. 1
- (b) Find the ratio of frequencies of the given two modes. 2



- (c) Prove that the fundamental frequency of an open pipe is twice the fundamental frequency of a closed pipe of the same length. 2
30. (a) A liquid will rise in a tube due to capillary action.
- (i) What do you mean by capillarity? 1
- (ii) Arrive an expression for the height (h) of liquid rise in the tube. 3
- (b) Two ideal tubes A and B dipped in water and soap solution respectively. In which case capillary rise is small? Explain. 1