P3ES-04

TIME: 1 HOUR

MAXIMUM SCORE:30

General Instructions to Students
- There is a **'cool-off time'** of 15 minutes in addition to maximum writing time
- Use cool-off time to get familiarise with questions and their answers
- **Read questions and instructions carefully before answering**
- Calculations, figures, graphs should be shown in the answer sheet itself
- **You can write questions as per instruction in each section to get a maximum score of 30**
- Electronic devices except **non-programmable calculators** are not allowed in the examination

Answer any 3 questions from 1 to 5. Each carries 1 score

1	Bursting of a balloon is a.... process? a) isothermal b) adiabatic c) isochoric d) isobaric	**1**
2	Write perfect gas equation.	**1**
3	Which one of the following relationships between the acceleration 'a' and the displacement 'x' of a particle involve simple harmonic motion? a) $a = 5x$ b) $a = -200 x^2$ c) $a = -5x$ d) $a = 100 x^3$	**1**
4	A simple pendulum is taken from the equator to the pole, its period a) Decreases b) Increases c) Remains same c) Becomes infinity	**1**
5	In transverse waves, the vibrations of the medium is...... (parallel/ perpendicular) to the propagation.	**1**

Answer any 5 questions from 6 to 13. Each carries 2 score

6	State the first law of thermodynamics.	**2**
7	Explain why two isothermal curves cannot intersect each other?	**2**
8	Is 'temperature' less than absolute zero possible? If not, why?	**2**
9	What do you understand by the term, mean free path of molecules? Name the factors on which it depends.	**2**
10	List any two conditions for a motion of a body to be simple harmonic.	**2**
11	Draw the graph showing the variation of KE, PE and Total energy of a particle executing SHM with displacement from the mean point.	**2**
12	What is the temperature at which the velocity of sound in air is twice the velocity at $0^{\circ}C$?	**2**
13	Write Newton–Laplace equation.	**2**

Answer any 3 questions from 14 to 17. Each carries 3 score

14	Derive the expression for work done in isothermal process.	**3**
15	Write four postulates of kinetic theory of gases.	**3**
16	The bob of a simple pendulum is a hollow sphere filled with mercury. It oscillates with a period T. As it is oscillating mercury flows out through a hole at the bottom. What happens to the period?	**3**
17	A transverse harmonic wave on a string is described by $y(x,t) = 3.0 \sin (36t + 0.018x + \pi/4)$ where x and y are in cm. and t in s. The positive direction of x is from left to right. a) Is it travelling or stationary wave? b) What is the initial phase at the origin? c) What are its amplitude and frequency?	 **1** **1** **1**

Answer any 2 questions from 18 to 20. Each carries 4 score

18	Thermodynamics deals with the concept of heat and the exchange of heat energy. a) Which law of thermodynamics is used to explain the working of heat engine? b) Explain briefly, the operations of a Carnot's engine, draw the Carnot's cycle and deduce the expression for its efficiency.	 **1** **3**
19	a) Prove that the oscillations of a simple pendulum are simple harmonic and hence derive an expression for the time period of a simple pendulum. b) What is the length of a simple pendulum, which ticks seconds? or All types of simple harmonic motion are periodic in nature. Derive the mathematical expressions for kinetic and potential energies of a particle executing simple harmonic motion.	**3** **1** **4**
20	What are the modes of vibration of the air column in a closed pipe?	**4**