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Roll No. [ ][ ][ ][ ][ ][ ]   Answer Sheet No._____

Sig. of Candidate._____   Sig. of Invigilator._____

PHYSICS HSSC–I
SECTION – A (Marks 17)

Time allowed: 25 Minutes

NOTE: Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1   Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i)   The dimensions of Power are:

    A. $[M L T^{-2}]$ B. $[M L T^{-3}]$ C. $[M^2 L^2 T^{-2}]$ D. $[M L^2 T^{-3}]$

(ii)   The significant figures in 34.678 are:

    A.   4   B.   3   C.   5   D.   2

(iii)   Two forces are acting together on an object. The magnitude of their resultant is minimum, when the angle between the forces is:

    A.   120°   B.   180°   C.   45°   D.   60°

(iv)   If the Scalar product of two vectors is $2\sqrt{3}$ and the magnitude of their vector product is 2. The angle between them is:

    A.   30°   B.   60°   C.   180°   D.   120°

(v)   A car starts from rest and covers a distance of 100 m in one second with uniform acceleration. Its acceleration is:

    A. $100\,m/s^2$ B. $200\,m/s^2$ C. $300\,m/s^2$ D. $50\,m/s^2$

(vi)   A ball rolls off the edge of a table. The horizontal component of the ball's velocity remains constant during its entire trajectory because:

    A.   The net force acting on the ball is zero

    B.   The ball is not acted upon by a force in the horizontal direction

    C.   The ball is acted upon by a force in the horizontal direction

    D.   The ball is acted upon by a force in the only vertical direction

(vii)   Which of the following is the example of conservative force?

    A.   Tension in the string   B.   Propulsion force of rocket

    C.   Gravitational field   D.   Restoring force in compressed spring

(viii)   Anybody requires _____ escape velocity, to escape from the gravitational pull of the mars.

    A.   2.4 km/s   B.   4.3 km/s   C.   5 km/s   D.   10.4 km/s

(ix)   In dryer, water is pushed out of wet clothes due to:

    A.   Abundance of centripetal force   B.   Lack of centripetal force

    C.   Friction   D.   Retarding force

(x)   The SI-unit of co-efficient of viscosity is:

    A. $Kgm^{-1}s^{-1}$ B. $Kgm^{-1}s^{-2}$ C. $Kgm^{-2}s^{-1}$ D. $Kgm^{-3}s^{-2}$

(xi)   A stone of mass 16 kg is attached to a string 144 m long and is whirled in a horizontal circle. The maximum tension the string can withstand is 16 N. the maximum velocity of revolution that can be given to the stone without breaking it, will be:

    A. $20\,ms^{-1}$ B. $16\,ms^{-1}$ C. $14\,ms^{-1}$ D. $12\,ms^{-1}$

(xii)   The property of fluid by which its own molecules are attracted is said to be:

    A.   Adhesion   B.   Cohesion   C.   Viscosity   D.   Surface Tension

(xiii)   A simple pendulum is moved from the Earth to the Moon. How does it change the period of oscillations? (Acceleration due to gravity on moon= $1.6\,m/s^2$)

    A.   The period is increased by factor $\sqrt{6}$ B.   The period is increased by factor four

    C.   The period is decreased by factor $\sqrt{6}$ D.   The period remains the same

(xiv)   Which of the following conditions is best for cooking purpose?

    A.   Isobaric   B.   Isochoric   C.   Adiabatic   D.   Isothermal

(xv)   What would be the efficiency of a Carnot engine operating with boiling water as one reservoir and a freezing mixture of ice and water as the other reservoir?

    A.   27%   B.   67%   C.   12%   D.   100%

(xvi)   Power of magnifying glasses is given by:

    A. $f + p$ B. $1 + \left(\dfrac{d}{f}\right)$ C. $1 - \left(\dfrac{f}{d}\right)$ D. $1 + fd$

(xvii)   Optically active substances are those substances which:

    A.   Produce Polarized light

    B.   Produce double refraction

    C.   Rotate the plane of polarization of polarized light

    D.   Convert a plane polarized light into circulatory polarized light

For Examiner's use only:

Total Marks: | 17 |

Marks Obtained: | |

—— 1HA 1708 (L)* ——

PHYSICS HSSC–I

Time allowed: 2:35 Hours   **Total Marks Sections B, C and D: 68**

NOTE: The Questions of sections B, C and D are to be answered on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 21)
(Chapters 1 to 6)

Q. 2   **Answer any SEVEN parts. All parts carry equal marks.**   **(7 x3 = 21)**

(i)   Write all possible rules for finding significant figures and significant zeros.

(ii)   Find the value of 'g' and its uncertainty using $T = 2\pi\sqrt{\dfrac{l}{g}}$ from the following measurements made during an experiment while $l = 100cm$ and time for 20 vibrations is $40.2s$. Length was measured by a meter scale of accuracy up to 1 mm and time by stop watch of accuracy up to 0.1 second.

(iii)   A uniform sphere of weight 10N is held by a string attached to a frictionless wall so that the string makes an angle of $30°$ with the wall as shown in figure. Find the tension in the string and the force exerted on the sphere by the wall.
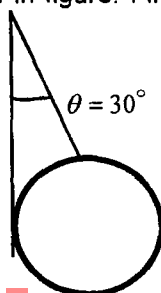
(iv)   Find the angle between two forces of equal magnitudes when the magnitude of their resultant is also equal to the magnitudes of either of these forces.

(v)   Find the angle of projection for which its maximum height (Vertical range) achieved and horizontal range of projectile are equal?

(vi)   A truck weighing 2500 kg and moving with a velocity of 21 m/s collides with stationary car weighing 1000 kg. The truck and the car move together after the impact. Calculate their common velocity.

(vii)   How large a force is required to accelerate an object from rest to a speed of $2 \times 10^7 m/s$ through a distance of 5cm, while the mass of electron is 9.1×10^{-31} kg?

(viii)   A disc and hoop start moving down form the top of an inclined plane at the same time. Which one will be moving faster on reaching the bottom and Why? (Justify your answer by using mathematical equations)

(ix)   What is the least speed at which an aeroplane can execute a vertical loop of 1 km radius so that there will be no tendency for the pilot to fall at the highest point.

(x)   Water flows downhill through a closed vertical funnel. The flow speed at the top is 12 cm/s, the flow speed at the bottom is twice the speed at the top. If the funnel is 40 cm long and the pressure at the top is $1 \times 10^5 N/m^2$, what is the pressure at the bottom?

SECTION – C (Marks 21)
(Chapters 7 to 11)

Q. 3   **Answer any SEVEN parts. All parts carry equal marks.**   **(7 x3 = 21)**

(i)   Name two characteristics of simple harmonic motion. Does Frequency depend on amplitude for harmonic oscillators? Also name some common phenomenon in which resonance plays an important role.

(ii)   Define simple pendulum. What are the drawbacks of simple pendulum? Can simple pendulum experiment be done inside a satellite?

(iii) A pipe has length one meter, determine the frequencies of the fundamental and first two harmonics:

    a.   If the pipe is open at its both ends

    b.   If the pipe is closed at its both ends

(iv) Define Doppler's Effect. And also write its few applications.

(v) Sketch out three differences between Interference and diffraction of light.

(vi) State Huygens's principle. Also distinguish between a wave-front and a wavelet by graphical sketch. (Graph paper is not required)

(vii) A glass light pipe in air will totally internally reflect a light ray if its angle of incidence is at least $39°$. What is the minimum angle for total internal reflection if pipe is in water? (The refractive Index of water is 1.33)

(viii) Define Near Point, Resolving Power and Continuous Refraction.

(ix) Why do we say that molar specific heat at constant pressure is greater than molar specific heat at constant Volume? $(C_p > C_v)$

(x) A steam engine has a boiler that operates at 450 k. The heat changes water to steam, which drives the piston. If the exhaust temperature of the outside air is about 300 k then calculate maximum efficiency of this steam engine?

SECTION – D (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks.   **(13 x 2 = 26)**

Q. 4   **a.** Define Absolute Potential energy. Derive relation for Absolute P.E of body having mass 'm' at distance 'r' from the centre of the earth.   **(1+5)**

     b. What is the gravitational field? Also discuss the factors on which work done by anybody in conservative field depends.   **(1+3)**

     c. What do you understand by the terms Critical velocity and Weightlessness.   **(1.5+1.5)**

Q. 5   **a.** What is Carnot Engine? Explain its all working steps, graphical sketch and also calculate its efficiency. Why do we say that Carnot cycle is reversible?   **(06)**

     b. Prove Boyle's law and Charles' law on the basis of kinetic theory of gases.   **(04)**

     c. Find the average speed of Oxygen molecule in the air at S.T.P.   **(03)**

Q. 6   **a.** What is Doppler's Effect? Discuss the following cases of Doppler's effect when: **(1+5)**

     (i) Both Observer and Source are at rest

     (ii) Observer moves towards stationary Source

     (iii) Observer moves away from stationary Source

     (iv) Source moves towards the stationary Observer

     (v) Source moves away from the stationary Observer

     b. What are beats? Explain it with the help of example as well as graphically. Also mention some of its uses.   **(04)**

     c. A stationary wave is established in a string which is 120 cm long and fixed at both ends. The string vibrates in four segments at a frequency of 120 Hz. Determine its wavelength and the fundamental frequency.   **(03)**

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Sig. of Candidate._____

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PHYSICS HSSC–I
SECTION – A (Marks 17)

Time allowed: 25 Minutes

NOTE: Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) A sound wave travelling in air has a wavelength of $1.6 \times 10^{-2}\ m$. If the velocity of sound is $320\ m/s$, calculate the frequency of sound.
   A. $2.0 \times 10^{8}\ Hz$ B. $2.0 \times 10^{2}\ Hz$ C. $2.0 \times 10^{5}\ Hz$ D. $2.0 \times 10^{7}\ Hz$

(ii) Which of the following pairs of units are both derived units?
   A. Kilogram, Angstrom B. Ampere, Degree
   C. Newton, Candela D. Joule, Watt

(iii) When two reference lines are drawn at right angles to each other, their point of intersection is called:
   A. Coordinate system B. Origin
   C. Coordinate Axis D. Rectangular components

(iv) Maximum number of components of a vector may be:
   A. Infinite B. One C. Two D. Three

(v) Motorcycle safety helmet extends the time of collision and decreases:
   A. Impulse B. Change of collision
   C. Force acting D. Velocity of Vehicle

(vi) A brick of mass 2 kg is dropped from a rest position 5 m above the ground. What is its velocity at a height of 3 m above the ground?
   A. 12.4 m/s B. 6.3 m/s C. 7 m/s D. 1.2 m/s

(vii) Anybody requires _____ escape velocity, to escape from the gravitational pull of the Venus.
   A. 5.5 km/s B. 2.4 km/s C. 4.3 km/s D. 10.4 km/s

(viii) One radian is equal to:
   A. $47.6°$ B. $34.3°$ C. $53.7°$ D. $57.3°$

(ix) The Dimensions of co-efficient of viscosity are:
   A. $ML^{-3}T^{-2}$ B. $ML^{-1}T^{-1}$ C. $ML^{-1}T^{-2}$ D. $ML^{-2}T^{-3}$

(x) A simple pendulum on earth has period of 6.0 s. What is the approximate period of this pendulum on the moon where the acceleration due to gravity is roughly $\frac{1}{6}$ th of earth's gravity.

   A. 15s B. 1.0 s C. 36 s D. 2.4 s

(xi) The temperature at which a system undergoes a reversible isothermal process without transfer of heat is called as:
   A. Reversible temperature B. Critical temperature
   C. Kelvin temperature D. Absolute zero temperature

(xii) A frictionless heat engine can be 100% efficient only if its exhaust temperature is:
   A. Zero kelvin B. Equal to its input temperature
   C. Less than its input temperature D. Freezing point of water

(xiii) The limit to which a microscope can be used to resolve details depends on:
   A. The width of eye piece and Longer Wavelength
   B. The width of objective and Short Wavelength
   C. The width of eye piece and Short Wavelength
   D. The width of objective and Longer Wavelength

(xiv) According to Laplace's point of view, sound waves travel in air under the conditions of:
   A. Isothermal B. Isobaric C. Isochoric D. Adiabatic

(xv) The refractive index of rarer medium with respect to a denser medium is:
   A. Zero B. 1 C. Greater than 1 D. Smaller than 1

(xvi) In a reversible cycle, the entropy of the system:
   A. First increases and then decreases B. Increases
   C. Decreases D. Does not change

(xvii) A telescope is made of an objective of focal length 20 cm and an eye piece of focal length 5 cm, both are convex lenses. Calculate the angular magnification.
   A. 15 B. 4 C. 5 D. 10

For Examiner's use only:

Total Marks: | 17
Marks Obtained: |

—— 1HA 1708 (ON)** ——

PHYSICS HSSC–I

Time allowed: 2:35 Hours

Total Marks Sections B, C and D: 68

NOTE: The Questions of sections B, C and D are to be answered on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 21)
(Chapters 1 to 6)

Q. 2 **Answer any SEVEN parts. All parts carry equal marks.** (7 x 3 = 21)

(i) The diameter and length of a metal cylinder measured with the help of Vernier Callipers of least count 0.01 cm are 1.22 cm and 5.35 cm. Calculate the volume of the cylinder and uncertainty in it.

(ii) Check the correctness of the relation $v = \sqrt{F \times \left(\dfrac{\ell}{m}\right)}$.

Whereas: v = speed of transverse wave F = Tension in string

ℓ = Length m = mass

(iii) Define: Parallel vectors, Equal vectors and Position vectors.

(iv) The magnitudes of dot and cross products of two vectors are $6\sqrt{3}$ and 6 respectively. Find the angle between the vectors.

(v) Prove that angles of projection, which exceed or fall short of $45°$ by equal amounts, the ranges are equal.

(vi) Two spherical balls of 2 kg and 3 kg masses are moving towards each other with velocities of 6 m/s and 4 m/s respectively. What must be the velocity of the smaller ball after collision, if the velocity of the bigger ball is 3 m/s?

(vii) What is the escape velocity? Discuss the factors on which escape velocity depends.

(viii) Discuss briefly the following energy sources:

a.   Energy from tides   b.   Energy form waves

(ix) Discuss briefly the Newton's and Einstein's views of gravitation.

(x) Define: Laminar and turbulent flow. Also write the characteristics of ideal fluid.

SECTION – C (Marks 21)
(Chapters 7 to 11)

Q. 3 **Answer any SEVEN parts. All parts carry equal marks.** (7 x 3 = 21)

(i) Can we realize an ideal simple pendulum? What happens to the period of a simple pendulum if its length is doubled? What happens if the suspended mass is doubled?

(ii) Under what conditions does the addition of two simple harmonic motions produce a resultant, which is also simple harmonic? When a mass spring system is hung vertically and is set into vibration then oscillation eventually stops. Why?

(iii) Why sound travels faster in warm air than in cold air? How should a sound source move with respect to an observer so that the frequency of its sound does not change?

(iv) What is stationary wave? Also define the terms: NODE, ANTINODE, FUNDAMENTAL FREQUENCY.

(v) Can sound waves be polarized? Explain briefly. What is Polaroid? Mention the uses of Polaroid.

(vi) In the white light spectrum obtained with diffraction grating, the third order image of a wavelength coincides with the fourth order image of second wavelength. Calculate the ratio of the two wavelength.

(vii) Explain briefly the difference between angular magnification and resolving power of an optical instrument. What limits are required for the magnification of an optical instrument?

(viii) Draw sketches showing the different light paths through a single-mode and multi-mode fibre. Why is the single-mode fibre preferred in telecommunications?

(ix) Why do we say that adiabatic curve is more steeper than isothermal curve?

(x) Calculate the efficiency of heat engine if it operates between freezing and boiling points of water.

SECTION – D (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. (13 x 2 = 26)

Q. 4 a. What is Projectile? Also derive expression for: (1+5)

   (i) Instantaneous Velocity

   (ii) Instantaneous displacement

   (iii) Instantaneous Height

   (iv) Instantaneous Horizontal Range

   (v) Total Time of flight

   b. Differentiate between: Ballistic missile, Ballistic trajectory (04)

   c. A boy places a fire cracker of negligible mass in an empty can of 40 g mass. He plugs the end with a wooden block of mass 200 g. after igniting the fire cracker he throws the can straight up. It explodes at the top of its path. If the block shoots out with a speed of 3 m/s, how fast will the can be going? (03)

Q. 5 a. Prove that simple pendulum obeys simple harmonic motion during its oscillation. Also derive Mathematical relations for time period and frequency of simple pendulum. (06)

   b. Write the characteristics of horizontal mass spring system. (04)

   c. Find the amplitude, frequency and period of an object vibrating at the end of a spring, if the equation for its position, as a function of time, is $x = 0.25 \cos\left[\dfrac{\pi}{8}\right]t$. What is the displacement of the object after 2 second. (03)

Q. 6 a. Describe the young's double slit experiment for demonstration of interference of light. Derive an expression for fringe spacing. Also write the conditions for interference of light. (06)

   b. Discuss Interference of thin film. (04)

   c. Yellow sodium light of wavelength 589 nm emitted by a single source passes through two narrow slits 1 mm apart. The interference pattern is observed on a screen 225 cm away. How far apart are two adjacent bright fringes? (03)