Federal Board

Annual 2009 HSSC-I

Section-A (Marks -17)

Q. 1   Insert the correct option i.e. A / B / C / D in the empty box provided opposite each part. Each part carries one mark.

(i)   Dimension of coefficient of viscosity is:

A. $\left[M L^{-1} T \right]$

B. $\left[M L^{2} T^{-1} \right]$

C. $\left[M L^{-1} T^{-1} \right]$

D. $\left[M L^{-1} T^{-2} \right]$

(ii)   Condition of complete equilibrium is satisfied, if:

A.   Vector sum of all the Torques is zero
B.   Vector sum of all the forces is zero
C.   Vector sum of all the forces and all the Torques is zero
D.   Its angular Momentum is zero

(iii)   The range of projectile is same for angles of projection:

A. $\left(30^{o}, \ 45^{o} \right)$

B. $\left(50^{o}, \ 45^{o} \right)$

C. $\left(45^{o}, \ 60^{o} \right)$

D. $\left(30^{o}, \ 60^{o} \right)$

(iv)   Which of the following types of forces can do no work on the particle on which it acts?

A.   Gravitational Force
B.   Frictional Force
C.   Centripetal Force
D.   Restoring Force

(v)   Non-renewable source of energy is:

A.   Uranium

B.   Wind

C.   Biomass

D.   Sunlight

(vi)   What happens to moment of inertia of thin rod when its length is doubled?

A. $\frac{1}{12} ML^{2}$

B. $\frac{1}{3} ML^{2}$

C. ML^{2}

D. $\frac{1}{6} ML^{2}$

(vii)   Speed of Efflux is _____ when height is doubled.

A. $\sqrt{2gh}$

B. $\sqrt[2]{gh}$

C. $\sqrt{gh}$

D. $\sqrt{\dfrac{gh}{2}}$

(viii) The two vectors to be combined have magnitudes $60N$ and $35N$. Pick the correct answer from those given below:

A. $70N$ B. $100N$

C. $20N$ D.   None of these

(ix) Speed of sound at $0^{\circ}C$ is $332\,ms^{-1}$, what is speed of sound at $20^{\circ}C$?

A. $348.2\,ms^{-1}$ B. $344.2\,ms^{-1}$

C. $340.0\,ms^{-1}$ D. $348.0\,ms^{-1}$

(x) Number of nodes between two consecutive antinode is:

A.   3   B.   4

C.   1   D.   Zero

(xi) Periodic Alternations of sound between maximum and minimum loudness are

A.   Destructive interfrance   B.   Beats

C.   Reflection   D.   Diffraction

(xii) Cladding in an optical fiber is used to:

A.   Absorb un-necessary light

B.   Refraction of light

C.   Transmission of light

D.   Produce total internal reflection

(xiii) Dimension of Angular Velocity are:

A. $\left[LT^{-1}\right]$ B. $\left[T^{-1}\right]$

C. $\left[L^{-1}T\right]$ D. $\left[L^{-1}T^{-1}\right]$

(xiv) When two notes of frequencies f_1 and f_2 are sounded together, beats are formed. If $f_1 > f_2$ what will be the frequency of beats?

A. $f_1 + f_2$ B. $\frac{1}{2}(f_1 + f_2)$

C. $f_1 - f_2$ D. $\frac{1}{2}(f_1 - f_2)$

(xv) For monoatomic gas $C_v = \frac{3}{2}R$ therefore "γ" for this gas is:

A. $\frac{3}{5}$ B. $\frac{5}{3}$

C. $\frac{4}{5}$ D. $\frac{15}{4}$

(xvi) Longitudinal waves do not exhibit:

A.   Polarization   B.   Refraction

C.   Reflection   D.   Diffraction

(xvii) An ideal reversible heat engine has:

A.   100% efficiency

B.   Highest efficiency

C.   An efficiency which depends on the nature of working substance.

D.   None of these

Q. 2 **Attempt any FOURTEEN parts. The answer to each part should not exceed 3 to 4 lines.** **(14 x 3 = 42)**

(i) Prove that $\left|\vec{A} \times \vec{B}\right|^2 + \left|\vec{A}.\vec{B}\right|^2 = A^2 B^2$

(ii) Can a body rotate about its centre of gravity under the action of its weight?

(iii) State the law of conservation of linear momentum, pointing out the importance of isolated system. Explain, why under certain conditions, the law is useful even though the system is not completely isolated.

(iv) What is meant by Kilowatt Hour? Show that $1\,kWh = 3.6\,MJ$

(v) When a rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this energy come form?

(vi) Explain the difference between tangential velocity and the angular velocity. If one of these is given for a wheel of known radius, how will you find the other?

(vii) What are Damped Oscillations? How does the amplitude of a damped simple harmonic wave changes with time as compared with an ideal un-damped harmonic wave?

(viii) Prove that $x = x_o \sqrt{1 - \dfrac{v^2}{v_o^2}}$

(ix) Explain, why sound travels faster in warm air than in cold.

(x) 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

$x = 0.25 \cos\left(\dfrac{\pi}{8}\right) t$

(xi) Check the correctness of the relation $v = \sqrt{\dfrac{F \times l}{m}}$ where v is the speed of transverse wave on a stretched string of tension F, length l and mass m.

(xii) At what point or points in its path does a projectile have its minimum speed, its maximum speed?

(xiii) How will the speed of transverse wave in a string change, if its tension is made four times?

(xiv) How is the distance between interference fringes affected by the separation between the slits of Young's Experiment? Can fringes disappear?

(xv) Sodium light $(\lambda = 589 \, nm)$ is incident normally on a grating having 3000 lines per centimetre. What is the highest order of spectrum obtained with this grating?

(xvi) The Moon's radius is $16 \, Km$ and $g_m = 1.6 \, ms^{-2}$ on its surface. Calculate the escape velocity at Lunar Surface.

(xvii) Work is done by friction. Will the entropy increase or decrease.

(xviii) Why an object, orbiting the earth, is said to be freely falling? Use your explanation to point out why objects appear weightless under certain circumstances?

(xix) Explain the difference between Angular Magnification and resolving power of an optical instrument. What limits the magnification of an optical instrument?

Section –C (Marks 26)

Note:-   Attempt any TWO questions.   (2 x 13 = 26)

Q. 3   a.   What do you mean by Projectile Motion? Define and obtain expressions for the following parameters: 07
(i)   Maximum height of Projectile
(ii)   Total time of flight
(iii)   Maximum range of Projectile

   b.   An object is thrown vertically upward. Discuss the sign of acceleration due to gravity relative to velocity while the object is in air.   02

   c.   A SLBM (Submarine launched ballistic missile) is fired from a distance of $3000 \, Km$. If the Earth is flat and the angle of launch is 45° with horizontal, find the time taken by SLBM to hit the target and the velocity with which the missile is fired.   04

Q. 4   a.   Derive Newton's formula for velocity of sound in air. Discuss the error in this formula.   06

   b.   Show that speed of sound in a given gas is independent of the pressure in the gas.   03

   c.   A steel wire hangs vertically from a fixed point, supporting a weight of $80 \, N$ at its lower end. The diameter of wire is $0.50 \, mm$ and its length from the fixed point to the weight is $1.5 \, m$. Calculate its fundamental frequency emitted by the wire when it is plucked.   04

Q. 5 **a.** What are the postulates of Kinetic Theory of gases? 03

b. On the bases of Kinetic Theory of gases, derive Gas laws (Boyle's and Charles' Law). 06

c. Show that ratio of the root mean square speeds of molecules of two different gases at a certain temperature is equal to the square root of the inverse ratio of their masses. 04