WITH

ANSWERS &

SOL'N HINTS

B I S E

MODEL PAPER

Inter Part-I (2006-2008)

MODEL PAPER "PHYSICS"

Intermediate Part - I Examination, 2007

(Academic session 2006 - 2008)

Roll No.
In Figures _____
In Words _____

OBJECTIVE

Time : 20 minutes

Marks : 17

Note : Write your Roll No. in the space provided. Cutting, overwriting erasing, using lead pencil will have no credit.

Q.No. 1 Each question has FOUR possible answers. Select the correct answer and encircle it.

(i) The dimensions of moment of inertia are
(a) ML^{-2} (b) ML^2 (c) M^2L (d) ML

(ii) The resultant of two forces 10N and 8N cannot be
(a) 2N (b) 18N (c) 10N (d) 12N — None of these

(iii) $\hat{i} . (\hat{j} \times \hat{k}) =$ ------ [$\hat{j} \times \hat{k} = \hat{i}$ & $\hat{i} . \hat{i} = 1$]
(a) $\hat{i}$ (b) $\hat{j}$ (c) $\hat{k}$ (d) 1

(iv) The velocity – Time graph is parallel to Time – axis, the acceleration of the moving body is
(a) Positive (b) Negative (c) Zero (d) Maximum

(v) A body of weight 5N falls through a height of 10m. Its energy 5m above ground is
(a) 25N (b) 50N (c) both 'a' and 'b' (d) 75N

(vi) The wt of man in an elevator moving down with an acceleration $9.8ms^{-2}$ will become
(a) half (b) double (c) unchanged (d) zero

(vii) The moment of linear momentum is called
(a) Impulse (b) Torque
(c) Angular momentum (d) Couple

(viii) High concentration of red blood cells increases the viscosity of blood from
(a) 2 – 3 times that of water (b) 3 – 4 times that of water
(c) 3 – 5 times that of water (d) 4 – 5 times that of water

(ix) **The product of time-period and frequency is equal to**

(a) 3 (b) 2 (c) 1 (d) 0

(x) **The velocity of sound in Hydrogen as compared to Oxygen under similar conditions is**

(a) $\frac{1}{4}$ the velocity in O_2 (b) Four times the velocity in O_2

(c) $\frac{1}{2}$ the velocity in O_2 (d) Two times the velocity in O_2

(xi) **When two notes of frequencies f_1 and f_2 are sounded together, beats are formed. If $f_1 > f_2$, then frequency of beats is**

(a) $f_1 + f_2$ (b) $f_1 - f_2$ (c) $\frac{f_1 + f_2}{2}$ (d) $\frac{f_1 - f_2}{2}$

(xii) **Light from sun reaches the earth in the form of**

(a) cylindrical wave front (b) spherical wave front

(c) plane wave front (d) all of the above

(xiii) **The central part of Newton's Rings when observed with reflected light is dark due to the reason that**

(a) The part of ray reflected from upper surface of convex lens undergoes a phase shift of 180°.

(b) The reflection from upper surface of air film undergoes a phase shift of 180°.

(c) The reflection from lower surface of air film undergoes a phase shift of 180°.

(d) ali of above

(xiv) **A double convex lens acts as a diverging lens when the object is**

(a) Inside the focus (b) away from 2f

(c) between f and 2f (d) on 2f

(xv) **Least distance of distinct vision**

(a) Increases with increase of age. (b) Remain same with increase of age.

(c) Decrease with increase of age. (d) all of these

(xvi) **The temp scale which is independent of the nature of the substance used in thermometer is called**

(a) Centigrade scale (b) Fahrenheit scale

(c) Kelvin or absolute scale (d) Thermodynamic scale

(xvii) **Which of the following process is irreversible**

(a) slow compression of an elastic spring.

(b) Slow evaporation of a substance in an isolated vessel.

(c) Slow compression of a gas.

(d) A chemical explosion.

MODEL PAPER "PHYSICS"

Intermediate Part - I Examination, 2007

(Academic session 2006 - 2008)

SUBJECTIVE

Time : 2.10 Hours **Marks = 68**

Note : Attempt any TWENTY TWO (22) questions from Section - I and any THREE questions from Section - II.

SECTION - I

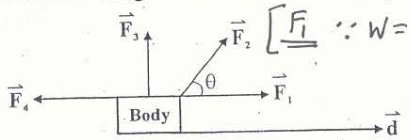
Q.No. 2 Write short answers to any twenty two of the following questions. **(2 × 22 = 44) Marks**

(i) Name the two physical quantities which have the same dimensional formula. Write their dimensions also. Work $= W = \vec{F}\cdot\vec{d} = \cdots [ML^2T^{-2}]$ Torque $= \tau = \vec{r}\times\vec{F} = \cdots [ML^2T^{-2}]$ Ans. Mom. & Impulse

(ii) Find the dimensions of η in the relation $F = 6\pi\eta rv$, r = radius and v = velocity. [Text Ex 1.6 page 18]

(iii) Write the name of two supplementary units and define than. [Radian & Steradian]

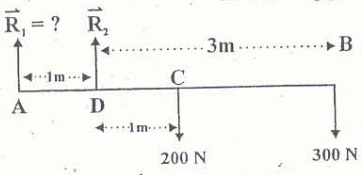
(iv) In Fig. which force will give max. work and why?



[$\vec{F}_1$ $\because W = F_1 d\cos 0^\circ = F_1 d$]

(v) Given that $\vec{A} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{B} = 3\hat{i} - 4\hat{k}$, find the length of the projection of $\vec{A}$ on $\vec{B}$ will be $A\cos\theta$: $\vec{A}\cdot\vec{B} = AB\cos\theta$ or $A\cos\theta = \frac{\vec{A}\cdot\vec{B}}{B} = \frac{(\hat{i}-2\hat{j}+3\hat{k})\cdot(3\hat{i}-4\hat{k})}{\sqrt{3^2+(-4)^2}} = \cdots = -\frac{9}{5}$

(vi) Find the value of unknown force $\vec{R}_1$ in the figure. (Rod AB is pivot at point D) Using 2nd condition of equilibrium. $\Sigma\tau = 0$ or $-R_1\times AD - 200\times CD - 300\times BD = 0$

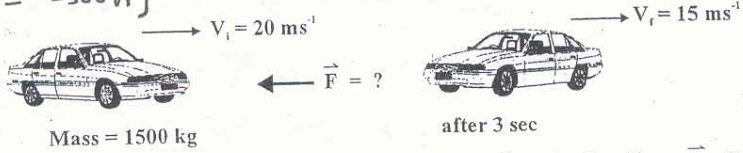


or $-R_1\times 1 - 200\times 1 - 300\times 3 = 0$

$\Rightarrow R_1 = 1100$ N upward direction

$v_f = v_i + at$
$15 = 20 + a\times 3$
$a = -5/3$
$F = ma = -1500\times 5/3$
$= -2500$ N

(vii),



Mass = 1500 kg

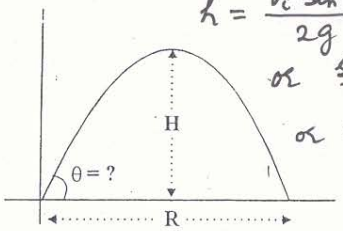
after 3 sec

In figure the velocity of car is reduced due to the retarding force $\vec{F}$, find its value.

(viii) Define impulse and show that how it is related to linear momentum?

$F = ma = \frac{m(v_f - v_i)}{t} = \frac{mv_f - mv_i}{t}$ or Impulse $= Fxt = mv_f - mv_i$

(ix) In figure, maximum height and horizontal range are equal, find the angle of projection of projectile.



$h = \frac{v_i^2 \sin^2\theta}{2g} = \frac{v_i^2}{g} 2\sin\theta\cos\theta = R$

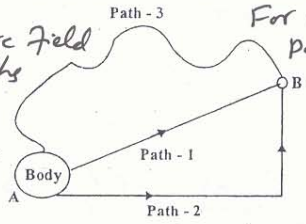
or $\frac{\sin\theta}{2} = 2\cos\theta$

or $\tan\theta = \frac{\sin\theta}{\cos\theta} = 4$

$\theta = \tan^{-1} 4 = 76^\circ$

(x) Prove that power is a scalar product of force and velocity $\left[P = \frac{\Delta W}{\Delta t} = \frac{\vec{F}.\Delta\vec{d}}{\Delta t} = \vec{F}.\vec{v}\right]$

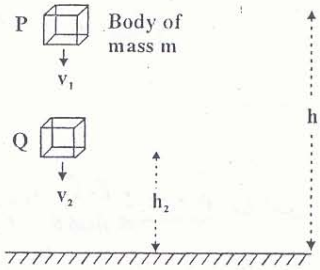
(xi) In figure, there are three paths between points A and B on which path the work done in moving a body from A to B will be maximum or remain same.



For Conservative field all these paths will have same W. done.

For Non-Conservative field, Path-3 will have max. W.done being longest path covered. as $W = Fd\cos\theta$ W.done depends upon F & d.

(xii) A body of mass m is falling down with velocity V_1 and at a height h_1 from a point P. If there is no frictional force, write the work - energy Eqn for the body at point Q.

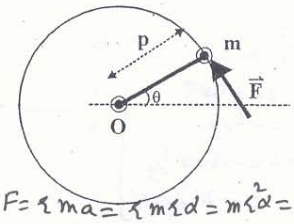


W.done = Change in KE

or Loss of PE = gain in KE

$mg(h_1 - h_2) = \frac{1}{2}m(v_2^2 - v_1^2)$

(xiii) Figure shows a mass m attached to a massless rod at 0 (pivot point). A force $\vec{F}$ is applied on it as shown. Find the value of TORQUE in terms of moment of inertia I and angular acceleration α.



$\tau = rF\sin 90^\circ = rF = rma = rmr\alpha = mr^2\alpha = I\alpha$

(xiv) A 1000 kg car traveling with a speed of 144 kmh^{-1} round a curve of radius 100m. Find the necessary centripetal force. $F_c = \frac{mv^2}{r} = \frac{1000 \times \left(\frac{144 \times 10^3}{60 \times 60}\right)^2}{100} = \cdots = 1.6 \times 10^4 N$

(xv) Describe what should be the minimum velocity for a satellite, to orbit close to the earth around it. $a_c = g = \frac{v^2}{r} \Rightarrow v = \sqrt{gr} = \sqrt{gR} = 7.9\ km\,s^{-1}$

(xvi) State the Torricellis' Theorem with diagram. $v_2 = \sqrt{2g(h_1 - h_2)}$

(xvii) Explain the difference between laminar flow and Turbulent flow. See "Definitions" page - 27

(xviii) Two row boats moving parallel in the same direction are pulled towards each others. Explain? See "Short Ans. to Questions" page - 19

(xx) A mass m is attached with a spring and pulled slowly through x_o against the elastic resoring force F, using Hook's Law, calculate the work done in displacing the mass and hence calculate elastic PE of the spring. → W. done = $PE_e = F_{av} \cdot d \cos 0° = \left(\frac{0 + kx_o}{2}\right) x_o = \frac{1}{2} k x_o^2$

(xxi) Explain S.H Motion for a body of mass m, attached with a spring of spring constant k. See "Auxiliary Notes" Article No. 2 (Simple H. Motion)

(xxii) Explain the terms crest, trough, node and antinode. See "Short Ans. to Questions" page-24

(xxiii) Name the three important cases of super position of two waves when act simultaneously upon the particles of medium. 1-Interference, 2-Beats, 3-Stationary Waves

(xxiv) What is Doppler effect? See "Core PHYSICS" page-14

(xxv) Draw the diagram of Michelson's Interferometer and write the equation by which we can find the displacement L of the mirror. See "Gem PHYSICS" § 9(ii)

(xxvi) Define Grating element. See "Auxiliary Notes" § 11 (Diffraction Grating)

(xxvii) How is the distance between interference fringes affected by the separation between the slits of Young's Experiment? See "Short Ans. to Questions" page-26

(xxviii) Draw the Ray-diagram of a compound Microscope. See "Core PHYSICS" page-15

(xxix) How the magnification of (i) Simple microscope and (ii) Astronomical Telescope changes by descreasing the focal length of an eye piece, Explain. Core PHY. Page-17

(xxx) Name the three types of optical fibres. "Core PHYSICS" page-18

(xxxi) State Ist law of Thermodynamics, with sign convension. "Core PHYSICS" page-20

(xxxii) Why $C_p > C_v$? "Core PHYSICS" page-20 [In C_p more Q is used for ΔW]

(xxxiii) Explain the principle of Heat engine with diagram. "Gem PHYSICS" § 11(iii)

SECTION - II

Note : Attempt any three questions. All questions carry equal marks.

$(3 \times 8 = 24)$

Q.No. 3 (a) Define VECTOR PRODUCT of two vectors with two examples. State right hand rule. Show that $\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}$ Text book pages 34-36

(b) Find the angle between two vectors, $\vec{A} = 5\hat{i} + \hat{j}$ and $\vec{B} = 2\hat{i} + 4\hat{j}$. → see "Solution Hints" page-12

Q.No.4 (a) Derive an expression for CENTRIPETAL Force. "Core PHYSICS" page-7

(b) What is the least speed at which an aeroplane can execute a vertical loop of 1.0 km radius so that there will be no tendency for the pilot to fall down at the highest point. $a_c = g = \frac{v^2}{r} \Rightarrow v = \sqrt{gr} = \sqrt{9.8 \times 1 \times 1000} = 99 \text{ ms}^{-1}$

Q.No.5 (a) State and prove Bernoullis Theorem. "Core PHYSICS" page-10

(b) How large must a heating duct be if air moving 3.0 ms^{-1} along it can replenish the air in a room of 300 m^3 volume every 15 min? "Partial Solns" p-12

Q.No.6 (a) Give drawback of Newton's formula for velocity of sound. How was corrected by Laplace. "Gem PHYSICS" § 8(i)

(b) Find the temperature at which the velocity of sound in air is two times its velocity at 10°C. Text book solved Exa 8.1 page 171

Q.No.7 (a) Prove that $C_p - C_v = R$ "Core PHYSICS" page-20

(b) A cannot engine whose low temperature reservoir is at 7°C has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how many degrees, the temperature of the hot source be increased? "Partial Solns" — 11.9