Version No.			

ROLL NUMBER						

Answer Sheet No._____

Sign. of Candidate

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Sign. of Invigilator

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PHYSICS SSC–I

SECTION – A (Marks 12)

Time allowed: 15 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

Q.1 Fill the relevant bubble for each part. All parts carry one mark.

1. If the number of vernier scale divisions is 20 and minimum main scale division is 1 mm, then Least count of vernier calipers is:

   A. 0.5 mm ◯ B. 0.05 mm ◯
   C. 0.01 mm ◯ D. 0.005 mm ◯

2. Thermometer is used to measure:

   A. Internal energy ◯ B. Total energy ◯
   C. Heat ◯ D. Temperature ◯

3. Which one of the following is a unit of momentum?

   A. Nm ◯ B. Ns ◯
   C. Nm^{-1} ◯ D. Ns^{-1} ◯

4. In speed-time graph, graphic line inclined to time axis with positive slope, shows:

   A. Uniform Velocity ◯ B. Uniform Acceleration ◯
   C. Variable Acceleration ◯ D. Negative Acceleration ◯

5. A body of mass 1500g is dropped from 20m high tower. It will reach the ground in:

   A. 6.5 seconds ◯ B. 5.0 seconds ◯
   C. 3.5 seconds ◯ D. 2.0 seconds ◯

6. A boy is pulling a box with a force of 50N which makes an angle of 60^0 with the ground. Its perpendicular components are:

   A. 4.33N, 25N ◯ B. 25N, 43.3N ◯
   C. 28.3N, 40N ◯ D. 15.5N, 35.5N ◯

7. Which one of the following is **NOT** true for couple acting on a steering wheel?

   A. $\Sigma F = 0$ ◯ B. $\Sigma\tau = 0$ ◯
   C. $\Sigma\tau \neq 0$ ◯ D. $\Sigma a = 0$ ◯

8. The mathematical form of an orbital velocity for a satellite revolving close to the Earth such that R>>h is:

A. $V_0 = \sqrt{g_h(R+h)}$ ◯ B. $V_0 = \sqrt{GR}$ ◯

C. $V_0 = \sqrt{Gh}$ ◯ D. $V_0 = \sqrt{Rh}$ ◯

9. One horse power is equal to:

A. 74.6 W ◯ B. 7.46×10^6 W ◯

C. 746 W ◯ D. 3.609 MW ◯

10. Hydraulic press is an application of:

A. Archimedes' Principle ◯ B. Pascal's Law ◯

C. Principle of flotation ◯ D. Newton's Law ◯

11. What will be the value of coefficient of volume thermal expansion β for a solid for which coefficient of linear thermal expansion α has value of $4 \times 10^{-5} K^{-1}$?

A. $12 \times 10^{-5} K^{-1}$ ◯ B. $6 \times 10^{-5} K^{-1}$ ◯

C. $4 \times 10^{-10} K^{-1}$ ◯ D. $8 \times 10^{-5} K^{-1}$ ◯

12. Land breeze and sea breeze are the result of:

A. Conduction ◯ B. Convection ◯

C. Radiation ◯ D. Insulation ◯

Federal Board SSC-I Examination
Physics Model Question Paper
(Curriculum 2006)

Time allowed: 2.45 hours Total Marks: 53

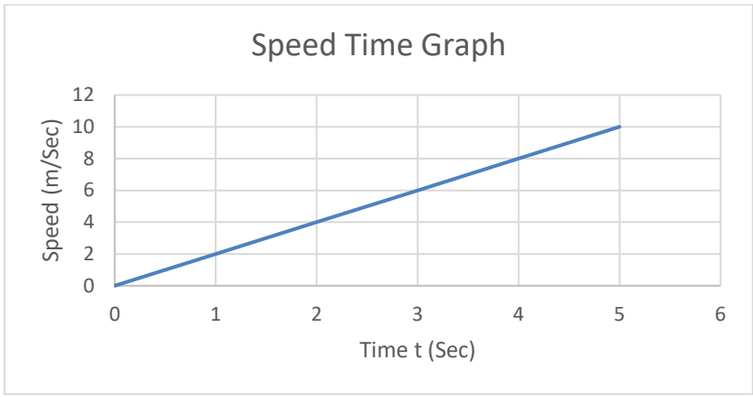
Note: Answer any eleven parts from Section 'B' and attempt any two questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

SECTION – B (Marks 33)

Q.2 Attempt any **ELEVEN** parts from the following. All parts carry equal marks.
$(11 \times 3 = 33)$

i. Differentiate between base physical quantities and derived physical quantities.
Base quantities are the quantities on the basis of which other quantities are expressed .For example mass, length, time.
The quantities that are expressed in terms of base quantities are called derived quantities. For example Area, Force, Pressure.

ii. Sketch a speed time graph, depicting uniform acceleration and find distance from this graph.



Total Distance Traveled = Area under the graph = Area of Triangle
Total Distance Traveled = ½ (Base x Height)
Total Distance Traveled = ½ (5 x 10)
Total Distance Traveled = 7.5 meter

iii. Define momentum, write its formula and unit.
Momentum is a measure of mass in motion: how much mass in in how much motion. It is defined as momentum of a body is the quantity of motion it possesses due to its mass and velocity.
The momentum P of a body is given by the product of its mass m and velocity v.
Thus P = mv
Momentum is a vector quantity. Its SI unit is $kgms^{-1}$.

iv. What will happen to a person sitting inside a bus when a bus turns a corner to theleft suddenly?
When a bus take a sharp turn, passengers fall in the outward direction. It is due to inertia that they want to continue to their motion in a straight line and thus falls outwards.

v. How does an artificial satellite keep on moving around the Earth?
To move in circular path we need centripetal fore. Like other natural satellites, artificial satellite also requires centripetal force to keep moving around earth. The gravitational force of attraction between the satellite and the earth provides necessary centripetal force to move it around earth.

vi. Define Torque. Write it's formula and unit.
The turning effect of a force is called torque ormoment of the force.
Mathematically torque can be written as $\tau = F\ X\ L$
The torque or moment of a force depends uponthe force F and the moment arm L of the force.
SI unit of torque is newton-meter (Nm). A torqueof 1 N m is caused by a force of 1 N acting perpendicularto the moment arm 1 m long.

vii. Why the height of a racing car is kept as low as possible?

The whole weight of an object acts on center of gravity. To increase stability center of gravity is lowered by decreasing height of an object or making it heavy at bottom. In case of racing car center of gravity must be close to the earth so that there are less chances of overturning of the car.

If the car is high, it is easy to produce the torque in car due to large moment arm, and the car can takes somersault (forward roll).

viii. How does gravitational acceleration varies with altitude?

As we know that

$$g_h = \frac{GM_e}{(R+h)^2}$$

Form above give equation

$$g \propto \frac{1}{R^2}$$

The above equation shows that the value of acceleration due to gravity g depends on the radius of the Earth at its surface. The value of g is inversely proportional to the square of the radius of the Earth. But itdoes not remain constant. It decreases with altitude. Altitude is the height of an object or place above sea level. The value of g is greater at sea level than at the hills.

ix. A force of 100N acts on a body of mass 20kg. The force accelerates the body from rest until it attains a velocity of $20ms^{-1}$. Through what distance the force acts?

Data/Given Data

Force = F = 100N

Mass = m = 20Kg

Velocity = v = 50 m/Sec

Finding

Distance through which the object will move = s = ?

Formula

Work Done = Energy

FS = ½ mv^2

Procedure

By putting values in above formula

100N x S = (½ x 20Kg x 50^2m/Sec)

S = ((½ x 20Kg x 50^2m/Sec)/(100N))

S = 250m

x. Why are fossil fuels called non-renewable form of energy?

The sources of energy which cannot be reused are called non-renewable form of energy. Fossil fuels such as coal, oil and gas are usually composed of hydrocarbons (compounds of hydrogen and carbon) once burnt cannot be reused, because the hydrogen and carbon combine with oxygen from air and form hydrogen oxide and carbon dioxide which cannot produce heat energy.

xi. State Hook's Law and write its mathematical form.

It has been observed that deformation in length, volume or shape of a body depends upon the stress acting on the body. Hooke's law states that:

The strain produced in a body by the stress appliedto it is directly proportional to the stress within theelastic limit of the body.

Mathematical form of Hooks law can written as

Constant = Stress/strain

F = Kx or K = F/x

xii. What makes a sucker to be pressed on a smooth wall?

The sucker is dish shaped, when pressed against a smooth surface the air is forced out beneath the sucker. The rubber makes as an air tight seal and the air pressure outside is greater than the air pressure beneath the sucker, thus forcing the rubber sucker to stick.

xiii. Describe latent heat of fusion and latent heat of vaporization.

Heat energy required to change unit mass of a substance from solid to liquid state at its meltingpoint without change in its temperature is calledits latent heat of fusion.

It is denoted by H_f

$$H_f = \frac{\Delta Q_f}{m}$$

The quantity of heat that changes unit mass of aliquid completely into gas at its boiling point without any change in its temperature is called itslatent heat of vaporization.

It is denoted by H_v

$$H_v = \frac{\Delta Q_v}{m}$$

xiv. How is evaporation used to produce cooling in a refrigeration process?

In general, Cooling is produced in refrigerators by evaporation. Refrigerators are cooled through the evaporation of volatile liquid (or aliquefied gas) behaving as refrigerant. The refrigerant evaporates very easily and this evaporation creates the cooling effect. Now a days in refrigerators hydro chloro floro carbon (HCFC) liquids or gas replaced Chloro floro carbons (CFC) gases. The compression and expansion of HCFC is reason of evaporation and cooling.

xv. How much heat lost in an hour through a glass window measuring 2.0m by 2.5m when inside temperature is 30^0C and that of outside is 5^0C, the thickness of the glass is 0.8cm and the value of thermal conductivity for glass is $0.8Wm^{-1}K^{-1}$?

Data/Given Data

Area of window = A = (2 x 2.5) m^2
Thickness of the glass = L= 0.8 x 10^{-2}m
Time = t = 3600S
$T_1 = 30^0C = 30 + 273 = 303K$
$T_2 = 5^0C = 5 + 273 = 278K$
Thermal conductivity of glass = $0.8Wm^{-1}K^{-1}$

Finding

Heat lost = Q =?

Formula

$Q/t = KA(T_1-T_2)/L$

Procedure

By putting values in above formula
$Q/t = KA(T_1-T_2)/L$
$Q = (KA(T_1-T_2)/L) \times t$
$Q = (0.8Wm^{-1}K^{-1} \times (2 \times 2.5)\ m^2 \times 25K)/ 0.8 \times 10^{-2}m) \times 3600S$
$Q = 4.5 \times 10^7\ J$

SECTION – C (Marks 20)

Note: Attempt any **TWO** questions. All questions carry equal marks. **(2 × 10 = 20)**

Q.3 a. Derive third equation of motion using speed time graph for a uniformly accelerated body. **(2+4)**

The equation of motion for bodies moving with uniform acceleration. These equations relate initial velocity, final velocity, acceleration, time and distance covered by a moving body. To simplify the derivation of these equations, we assume that the motion is along a straight line. Hence,we consider only the magnitude of displacements, velocities, and acceleration.

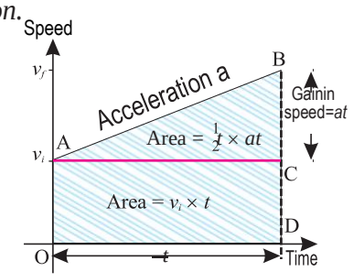


Figure 3.1a Speed Time Graph

Consider a body moving with initial velocity v_i in a straight line with uniform acceleration a. Its velocity becomes v_f after time t. The motion of body is described by speed-time graph as shown in figure 3.1a. The slope of line AB is acceleration a. The totaldistance covered by the body is shown by the shaded

area under the line AB. Equations of motion can be obtained easily from this graph.

In speed-time graph shown in figure 3.1a, the total distance S travelled by the body is given by the total area OABD under the graph.

Total area OABD $S = \frac{OA+BD}{2} X\ OD$

Or

$$2S = (OA + BD)\ X\ OD$$

Multiply both sides by $\frac{BC}{OD}$*, we get:* $\left(\frac{BC}{OD} = a\right)$

$$2S\ X\ \frac{BC}{OD} = (OA + BD)X\ ODX\ \frac{BC}{OD} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

$$2S\ X\ \frac{BC}{OD} = (OA + BD)X\ BC$$

As we know that
BC = BD-CD,
BD = V_f *, CD =*V_i *, OD = t , OA =* V_i*,*

By putting values in equation number 1, we get

$$2S\ X\ a = \left(V_i + V_f\right)\ X\ ((V_f - V_i)$$
$$2aS = \ V_f^2 - V_i^2$$

b. How does friction play an important role in our daily life? **(4)**

Friction plays very important role in our daily life, here we write its few examples. We cannot write if there would be no friction between paper and the pencil. Friction enables us to walk on theground. We cannot run on a slippery ground. A slipperyground offers very little friction. Hence, anybody who tries to run on a slippery ground may meet an accident.Similarly, it is dangerous to apply brakes with full force tostop a fast moving vehicle on a slippery road. Birds couldnot fly, if there is no air resistance.

Q.4 a. Define resolution of a force. How can a force making an angle θ with *x*-axis, be resolved into its perpendicular components? **(2+4)**

The process of splitting up vectors (forces) into theircomponent forces is called resolution of forces. If a forceis formed from two mutually perpendicular componentsthen such components are called its perpendicularcomponents.
Splitting up of a force into two mutually perpendicular components is called the resolutionof that force.

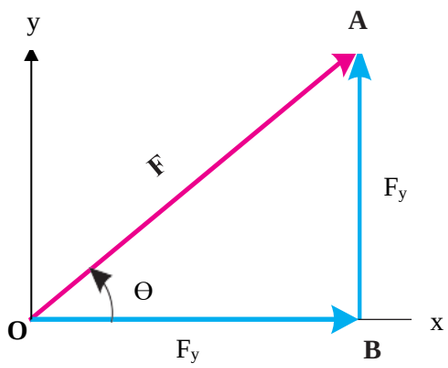


Figure 4.1a Resolution of Vectors

Consider a force ***F*** *represented by line OA making anangle θ with x-axis as shown in figure 4.1a*

Draw a perpendicular ***AB*** *on x-axis fromA. Accordingto head to tail rule,* ***OA*** *is the resultant of vectors represented by* ***OB*** *and* ***BA.***

Thus OA = OB + BA ……..(4.1a)

The components ***OB*** *and* ***BA*** *are perpendicular to* $\mathbf{F}_y$ *each other. They are called the perpendicularcomponents of* ***OA*** *representing force* ***F.*** *Hence* ***OB*** *represents its x-component* $\boldsymbol{F}_x$ *and* ***BA*** *represents its y-component* $\boldsymbol{F}_y$*. Therefore, equation 4.1a can be written as*

$F = \boldsymbol{F}_x + F_y$ …….. *(4.2a)*

The magnitudes F_x and F_y of forces $\mathbf{F}_x$ and $\mathbf{F}_y$ can befound using the trigonometric ratios. In right angledtriangle OBA

Since

$$\frac{F_x}{F} = \frac{OB}{OA} = cos\theta$$

$$F_x = Fcos\theta \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.3a)$$

Similarly

$$\frac{F_y}{F} = \frac{BA}{OA} = sin\theta$$

$$F_y = Fsin\theta \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.4a)$$

Equations 4.3a and 4.4a give the perpendicularcomponents F_x and F_y respectively.

b. Calculate mass of Earth using Newton's Law of gravitation. **(4)**

Consider a body of mass m on the surface of theEarth as shown in figure 4.1b

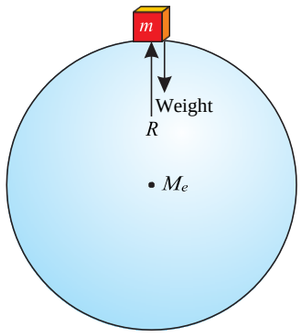


Figure 4.1b. An object Placed on surface of Earth attracted towards the earth center.

Let the mass of the Earth be M_e and radius of the Earth be R. The distance of the body from the centre of the Earth will also be equal to the radius R of the Earth. According to the law of gravitation, the gravitational force F of the Earth acting on a body is givenby

$$F = G\frac{mM_e}{R^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.1b)$$

But the force with which Earth attracts a body towardsits centre is equal to its weight w. Therefore,

$$F = W = mg \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.2b)$$

Or

$$mg = G\frac{mM_e}{R^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.3b)$$

$$g = G\frac{M_e}{R^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.4b)$$

And $$M_e = \frac{gR^2}{G} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.5b)$$

Mass M_e of the Earth can be determined onputting the values in equation (4.5b)

$$M_e = \frac{(6.4\times10^6\ \text{m})^2 \times 10\,\text{m s}^{-2}}{6.673\times10^{-11}\,\text{Nm}^2\text{kg}^{-2}}$$

$$M_e = 6.0\times10^{24}\ \text{kg}$$

Thus, mass of the Earth is 6.0 x 10^{24}Kg

Q.5 a. State and explain Archimedes' Principle.

An air filled balloon immediately shoots up to the surface when released under water. The same would happen if a piece of wood is released under water. We might have noticed that a mug filled with water feels lightunder water but feels heavy as soon as we take it out ofwater.

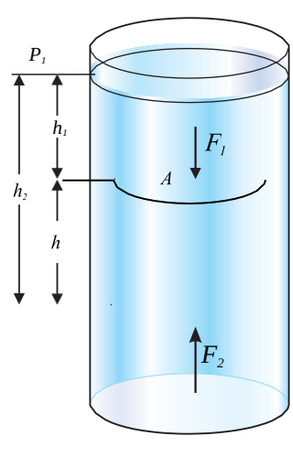


Figure 5.1a Upthrust on a body immersed in a liquid is equal to the weight of the liquid displaced.

More than two thousand years ago, the Greek scientist, Archimedes noticed that there is an upward force which acts on an object kept inside a liquid. As a result an apparent loss of weight is observed in the object. This upward force acting on the object is called the upthrust of the liquid. Archimedes principle states that:

When an object is totally or partially immersed in a liquid, an upthrust acts on it equal to the weight ofthe liquid it displaces.

Consider a solid cylinder of cross-sectional area A and height h immersed in a liquid as shown in figure 5.1a. Let h_1 and h_2 be the depths of the top and bottom faces of the cylinder respectively from the surface of theliquid.

Then

$$h_2 - h_1 = h$$

If $P_1$and P_2 are the liquid pressures at depths $h_1$and h_2 respectively and ρ is its density, then according toequation for liquids in pressure

$$P_1 = \rho g h_1$$

$$P_2 = \rho g h_2$$

Let the force is exerted at the cylinder top by the liquid due to pressure P_1 and the force F_2 is exerted at the bottom of the cylinder by the liquid due to P_2.

$\therefore \quad F_1 = P_1 A = \rho g h_1 A$

and $\quad F_2 = P_2 A = \rho g h_2 A$

F_1 and F_2 are acting on the opposite faces of the cylinder. Therefore, the net force F will be F_2- F_1 in the direction of F_2. This net force F on the cylinder is calledthe upthrust of the liquid.

$$\therefore F_2 - F_1 = \rho g h_2 A - \rho g h_1 A$$

$$= \rho g A (h_2 - h_1)$$

or Upthrust of liquid $= \rho g A h$ *……..(5.1a)*

or Upthrust of liquid $= \rho g V$ *……..(5.2a)*

Here Ah is the volume V of the cylinder and is equal to the volume of the liquid displaced by the cylinder. Therefore, ρgV is the weight of the liquid displaced. Equation (5.2a) shows that an upthurst acts onthe body immersed in a liquid and is equal to the weightof liquid displaced, which is Archimedes principle.

b How much ice will melt by 5000J of heat? Latent heat of fusion of ice is 336000 Jkg^{-1}.

Data/Given Data
Latent heat of Fusion of ice = H_f = 336000J/kg
Heat = ΔQ = 5000J
Finding
Mass of ice = m = ?
Formula
$\Delta Q_f = mH_f$
Procedure
By putting values in above formula
$\Delta Q_f = mH_f$
$m = \Delta Q_f / H_f$
$m = 5000J/336000JKg^{-1}$
m = 14.880g
m = 15g