Version No.					ROLL NUMBER						
0	0	0	0		0	0	0	0	0	0	0
1	1	1	1		1	1	1	1	1	1	1
2	2	2	2		2	2	2	2	2	2	2
3	3	3	3		3	3	3	3	3	3	3
4	4	4	4		4	4	4	4	4	4	4
5	5	5	5		5	5	5	5	5	5	5
6	6	6	6		6	6	6	6	6	6	6
7	7	7	7		7	7	7	7	7	7	7
8	8	8	8		8	8	8	8	8	8	8
9	9	9	9		9	9	9	9	9	9	9

Answer Sheet No.____________

Sign. of Candidate___________

Sign. of Invigilator___________

PHYSICS SSC–I (2nd Set Solution)

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. Which instrument you will use to find the diameter of a thin wire:
   - A. Manometer ○
   - B. Micrometer Screw gauge ●
   - C. Vernier callipers ○
   - D. Interferometer ○

2. Pick the **INCORRECT** prefix:
   - A. 1ms = 10^{-3}s ○
   - B. 1dm = 10^{-1}m ○
   - C. 1cm = 10^{-2}m ○
   - D. 1μ m = 10^{6}m ●

3. If velocity of a body is increasing then its acceleration is:
   - A. Positive ●
   - B. Negative ○
   - C. Zero ○
   - D. Infinite ○

4. Height of Geostationary satellite from the surface of Earth is about:
   - A. 43,200km ○
   - B. 42,300km ●
   - C. 34,200km ○
   - D. 44,300km ○

5. Force of friction acts:
   - A. in the direction of motion ○
   - B. perpendicular to the direction of motion ○
   - C. against the direction of motion ●
   - D. at an acute angle to the direction of motion ○

6. The power needed to lift a mass of 10kg to a height of 1m in a time of 5sec is:
   - A. 50W ○
   - B. 20W ●
   - C. 200W ○
   - D. 100W ○

7. Which property of a body can **NOT** change if a force is applied to it?
   - A. mass ●
   - B. size ○
   - C. shape ○
   - D. velocity ○

8. Identify the renewable source of energy:

A. fossil fuel energy ○ B. nuclear energy ○

C. wind energy ● D. electrical energy ○

9. The centre of gravity of a square shaped body lies at the:

A. point of intersection of diagonals ●

B. its upper face ○

C. edge of square ○

D. its base ○

10. If two forces of magnitude 3N and 4N are acting on a body perpendicularly then the magnitude of their resultant is:

A. 7N ○ B. 5N ●

C. 1N ○ D. 3N ○

11. The weight of an object in air is 10N and its weight in water is 6N. What will be the upthrust acting on it?

A. 16N ○ B. 10N ○

C. 4N ● D. 60N ○

12. The unit of specific heat capacity is:

A. Jkg^{-1} ○ B. $Jkg^{-1}K^{-1}$ ●

C. $Jkg^{-1}K$ ○ D. $JkgK^{-1}$ ○

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 × 3 = 33)

i. Write down any three rules to determine the significant figures in any measurement?

Ans. 1. Digits other than zero are always significant.
27 has 2 significant digits.
275 has 3 significant digits.

2. Zeros between significant digits are also significant.
2705 has 4 significant digits.

3. Final zero or zeros after the decimal are significant
275.00 has 5 significant digits.

ii. How circular and rotatory motions are different from each other? (any three)

Ans. Differences in circular and rotatory motion:

Circular Motion:
The motion of an object in a circular path is known as circular motion. The axis of rotation are fixed is circular motion.

Examples:
A toy train moving on a circular track. A bicycle or a car moving along a circular track possesses circular motion. The motion of the Earth around the Sun and the motion of the moon around the Earth are also examples of circular motions.

Rotatory motion:
The spinning motion of a body about its axis is called rotatory motion. In rotatory motion, the line, around which a body moves about, is passing through the body itself.

Examples:
The motion of a wheel about its axis and that of a steering wheel are the examples of rotatory motion. The motion of Earth about its geographic axis that causes day and night is rotatory.

iii. Worn out tyres of vehicles are not safe to use on wet roads. Why?

Ans. It is dangerous to drive on a wet road because the friction between the road and the tyres are very small. This increases the chance of slipping the tyres from the road. The threading on tyres is designed to increase friction. Thus, threading improves road grip and make it safer to drive even on a wet road.

iv. How much centripetal force is needed to make a body of mass 0.5 kg to move in a circle of radius 50 cm with a speed of 5 ms^{-1}?

Ans.
Mass of body = m = 0.5 kg
Radius of the circle = r = 50 cm = 0.5 m
Speed of body = v = 5 ms^{-1}
Centripetal force = Fc = ?
$Fc = mv^2/r$
$Fc = (0.5x\ (5)^2\ )/\ 0.5$
Fc = 25 N

v. A boy completes a circular track of radius 20 meters in 3 minutes. Find his average speed.

Ans.
Time = t = 3 min=180 s
Radius of track = 20 m
Distance = S = $2\pi r$= $2\pi x20$= 125.66 m
Speed = total distance/time
S = 125.66/180
S = 0.7 ms^{-1}

vi. Couple produces rotation in the steering wheels. How?

Ans. When a driver turns a steering wheel, he exerts two equal but opposite forces on it. The two forces form a couple. The turning effect of a couple is the sum of moment of the two forces. The moment of a couple is called Torque.

vii. The gravitational force between two similar iron balls kept at 100 cm apart is 0.006673 N. Find the mass of each sphere?

Ans.
Gravitational force = F = 0.006673 N
Gravitational constant = G = $6.673 \times 10^{-11}\ Nm^2kg^{-2}$
Distance between the centre of iron balls = d = 100 cm=1 m
Mass = $m_1 = m_2$ =?
$F = Gm_1m_2/d^2$
$F = Gm^2/d^2$ $(m_1 = m_2 = m)$
$m^2 = Fxd^2/G$
$m^2 = 0.006673\ x\ (1)^2\ /\ 6.673x(10)^{-11}\ kg^2$
$m^2 = 10^8\ kg^2$
Taking square root on both side:
$m = 10^4$ kg = 10000 kg $(m = m_1 = m_2)$
Therefore, mass of each lead sphere is 10000 kg.

viii. Explain why hot gases rise?

Ans. Transfer of heat by actual movement of molecules from hot place to a cold place is known as convection. Liquids and gases are poor conductors of heat. However, heat is transferred through fluids (liquids or gases) easily by another method called convection. Convection currents in air. Gases also expand on heating; thus, convection currents are easily set up due to differences in the densities of air at various parts in the atmosphere. The hot air currents move upward due to convection of heat. These rising currents of hot air are called thermals.

ix. If a single force acts on a body, it cannot be in equilibrium under this single force. Why?

Ans. When only a single force present, the body will accelerate in the direction of the force according to Newton's 2^{nd} law F = ma. However, if two opposite and equal forces take part it gives rise to a null vector force and object can be in equilibrium.

x. What is meant by the efficiency of a system? How can you find efficiency of a system?

Ans.
The ratio of the useful work done by a device or machine to the total energy taken up by it is called its efficiency.
OR
Efficiency of a system is the ratio of the required form of energy obtained from a system as output to the total energy given to it as input.

Efficiency = required form of output / total input energy …..(i)
% Efficiency = required form of output / total input energy × 100 ….. (ii)

xi. A nail can penetrate a hard surface easily compared to wide bolt. Why?

Ans. The force acting normally per unit area on the surface of a body is called pressure. Thus
Pressure P = Force / Area
Or P = F / A
This shows pressure will be large if area is small and vice versa. The area of nail is smaller as compared to bolt so it penetrates easily in hard surface compared to wide bolt.

xii. What is the effect of large specific heat capacity of water in our everyday life?

Ans.
Specific heat of water is 4200 Jk and that of dry soil is about 810 Jk. As a result, the temperature of land rises and falls more rapidly than that of the sea. Hence, the temperature variations from summer to winter are much smaller at places near the sea than land far away from the sea.
Water has a large specific heat capacity. In an automobile, a large amount of heat is produced by its engine due to which its temperature goes on increasing. The engine would cease unless it is not cooled down. Water circulating the engine by arrows maintains its temperature. Water absorbs unwanted thermal energy of the engine and heat through its radiator.

xiii. Submarines are designed to move over and under the sea. Explain briefly?

Ans. A submarine can travel over as well as underwater. It also works on the principle of floatation. It floats over water when the weight of water equal to its volume is greater than its weight. Under this condition, it is similar to a ship and remains partially above water level. It has a system of tanks which can be filled with and emptied from seawater. When these tanks are filled with seawater, the weight of the submarine increases. As soon as its weight becomes greater than the upthrust, it dives into the water and remains underwater. To come upon the surface, the tanks are emptied from seawater.

xiv. How double glazed windows help to keep room cool when it is hot outside?

Ans. Double glazed window is used due to its insulative properties. Double glazed works by limiting the amount of heat energy that can transfer from one side of window to other through convection. It is done by placing two separate panes of glass parallel to one another and leaving an empty space in between. When one side of glass becomes hotter but this heat energy unable to pass through the empty space on other side. The heat transfer is thus slowed downed.

xv. Steam causes severe burns than boiling water. Why?

Ans. Steam has more energy than boiling water. It possesses the additional latent heat of vaporization. So, when steam falls on the skin and condenses to produce water it gives out 22.5 x 10^5 J/kg more heat than boiling water at the same temperature. Therefore, burns produced by steam are more severe than those produced by boiling water.

SECTION – C(Marks 20)

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

Q.3 a. What is law of conservation of momentum? Determine the recoil velocity of the gun when a bullet is fired from it. **(6)**

Ans. **Law of conservation of momentum:**
The momentum of an isolated system remains constant.
Example:
Consider the example of an air-filled balloon. In this case, the balloon and the air inside it form a system. Before releasing the balloon, the system was at rest and hence the initial momentum of the system was zero. As soon as the balloon is set free, air escapes out of it. The air coming out of it possesses momentum. To conserve momentum, the balloon moves in a direction opposite to that of air rushing out.
Explanation:
Recoils of gun:
Consider a system of bullet and gun. Before firing the gun, both the bullet and gun are at rest, the total momentum of the system is zero. As the gun is fired, bullet shoots out of the gun and acquires momentum. To conserve the momentum of the system, the gun recoils.
According to the law of conservation of momentum, the total momentum of the gun and the bullet will also be zero after the gun is fired.
Let m be the mass of the gun and v be its velocity on firing the gun; M be the mass of the gun and V be the velocity with which it recoils. Thus the total momentum of the gun and the bullet after the gun is fired will be.

[Total momentum of the gun and the bullet after the gun is fired]= MV + mv……(i)

According to the law of conservation of momentum,

(Total momentum of the gun and the bullet after the gun is fired) = (Total momentum of the gun and bullet after the gun is fired)

MV+ mv=0

Or MV = -mv

Hence $V = -mv/M$……….(ii)
Equation (ii) gives the velocity V of the gun. Negative sign indicates that velocity of the gun is opposite to the velocity of the bullet i.e., the gun recoils. Since the mass of the gun is much larger than the bullet, therefore the recoil is much smaller than the velocity of the bullet.

b. A car moves with uniform velocity of 20 ms^{-1} for 3s. It comes to rest in next 5s with uniform deceleration. Find the total distance travelled by car? **(4)**

Ans. Initial velocity = V_i = 20 ms^{-1}
Time = t = 3 s
Final velocity = V_f = 0 ms^{-1}
Time = 5 s

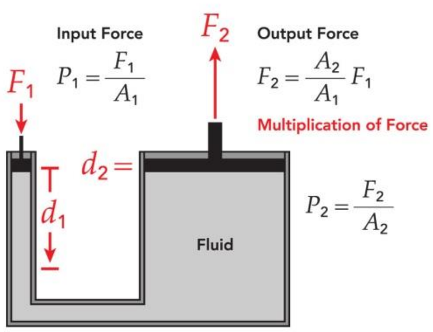
deceleration = a =?

total distance = S =?
$V_f = V_i + at$
Or $at = V_f - V_i$
$a = V_f - V_i/t$
$a = 0 - (20/5)$
$a = -4\ ms^{-2}$
Total distance travelled = $S = S_1 + S_2$
By using this relation
$S_1 = Vt$
$S_1 = 20 \times 3$
$S_1 = 60$ m ………………………………. (i)
Now by using 3rd equation of motion
$2aS = V_f^2 - V_i^2$
$S_2 = \frac{v_f^2 - v_i^2}{2a}$
$S_2 = ((0)^2 - (20)^2/2) \times (-4)$
$S_2 = -400/-8$
$S_2 = 50$ m …………………………………….. (ii)
From (i) and (ii) we get;
$S = S_1 + S_2$
Or $S = 60\text{ m} + 50\text{ m}$
$S = 110$ m

Q.4 a. Hydraulic press is also known as force multiplier. Explain with the help of Pascal's law? **(6)**

Ans. **Pascal's law:**
Pressure, applied at any point of a liquid enclosed in a container, is transmitted without loss to all other parts of the liquid.
Pascal's law finds numerous applications in our daily life such as automobiles hydraulic brake system, hydraulic jack, hydraulic press and other hydraulic machine.

Hydraulic Press:
A hydraulic press is a machine which works on Pascal's law. It consists of two cylinders of different cross-sectional areas. They are fitted with pistons of cross-sectional areas a and A.
The object to be compressed is placed over the piston of large cross-sectional area A. The force F_1 is applied to the piston of the small cross-sectional area a. The pressure P produced by the small piston is transmitted equally to the large piston and a force F_2 acts on A which is much larger than F_1.



$F_1 d_1 = F_2 d_2$

$d_1 = \frac{F_2}{F_1} d_2 = \frac{A_2}{A_1} d_2$

Pressure on the piston of the small area a is given by:
$P = F_1 / a$ ………………..(i)
Apply Pascal's law, the pressure on the large piston of area A will be the same as on small piston.
$P = F_2 / A$ ………………..(ii)
Comparing the above equation (i) and equation (ii) we get,
$F_1 / a = F_2 / A$
$F_2 = A \times (F_1 / a)$
Or $F_2 = F_1 A / a$ ………………..(iii)
Note: Since the ratio A/a is greater than 1, hence the force F_2 that acts on the larger piston is greater than the force F_1 acting on the smaller piston. Hydraulic systems working in this way are known as force multipliers.

b. Define stress, strain and Young's modulus. **(4)**

Ans. **Stress:**
The force acting on unit area on the surface of a body is called stress.
stress = Force / Area
Unit: In SI, the unit of stress is Newton per square metre (Nm^{-2}).
Strain:
A comparison of such a change caused by the stress with the original length, volume or shape is called as strain.
If stress produces a change in the length of an object then the strain is called tensile strain.
Tensile strain = Change in length / Original length
Strain has no units as it is simply a ratio between two similar quantities.
Young's modulus:
The ratio of stress to tensile strain is called Young's Modulus.
Determination of Young's Modulus:
Consider a long bar of length L_0 and cross-sectional area A. Let an external force F equal to the weight w stretches it such that the stretched length becomes L. According to Hooke's law, the ratio of this stress to tensile strain is constant within the elastic limit of the body.
Young's modulus Y = Stress / Tensile strain
Let ΔL be the change in length of the rod, then
$$\Delta L = L - L_0$$
Since Stress = Force / Area = F/A
And Tensile strain = $L - L_0 / L_0 = \Delta L / L_0$
As Y = Stress / Tensile strain
$= F/A \times L_0 / \Delta L$
$Y = FL_0 / A\Delta L$
Unit: SI unit of Young's Modulus is Newton per square metre (Nm^{-2}).

Q.5 a. Define linear thermal expansion of solids. Derive the relation for it. How coefficient of linear and coefficient of volumetric thermal expansions are related. **(6)**

Ans. **Linear Thermal expansion:**
Linear thermal expansion is the tendency of matter to change in length in response to a change in temperature.
On heating, the amplitude of vibration of the atoms and molecules of an object increases. They push one another farther away as the amplitude of vibration increases. Thermal expansion results in an increase in length, breadth and thickness of a substance.
Linear thermal expansion in solids:
Consider a metal rod of length Lo at a certain temperature ΔT. Let its length on heating to a temperature T becomes L Thus
Increase in length of the rod = $\Delta L = L - Lo$
Increase in temperature = $\Delta T = T - \Delta T$
It is found that change in length Δ L of a solid is directly proportional to its original length and the change in temperature Δ T. That is;

$\Delta L \propto Lo \, \Delta T$

or $\Delta L = \alpha \, Lo \, \Delta T$ ………. (i)

or $L - Lo = \alpha \, Lo \, \Delta T$

or $L = Lo + \alpha \, Lo \, \Delta T$

or $L = Lo \, (1 + \alpha \, \Delta T)$ ………. (ii)

where α is called the coefficient of linear thermal expansion of the substance.

From equation (i), we get

$\alpha = \Delta L / Lo \, \Delta T$ (iii)

Coefficient of linear thermal expansion :

We can define the coefficient of linear expansion of a substance as the fractional increase in its length per kelvin rise in temperature.

We can define the temperature coefficient of volume expansion as the fractional change in its volume per kelvin change in temperature. The coefficient of linear expansion and volume expansion are related by the equation:

$\boldsymbol{\beta = 3\alpha}$

b. At what altitude the value of 'g' would become one ninth than at the surface of Earth. **(4)**

Ans.

$g_h = 1/9^{th} \, g$

$g_h = G \, Me/ (R+h)^2$ ………. (i)

$1/9g = GMe/(R+h)^2$

$(R+h)^2 = 9GMe/g$

$R+h = 3\sqrt{GMe/g}$ $(g = G \, Me/ R^2)$

$h = 3\sqrt{GMe/g} - R$

$h = 3R - R$

$h = 2R$ $(R = 6.4 \times 10^6 \, m)$

$h = 2 \times (6.4 \times 10^6 \, m)$

$h = 12.8 \times 10^6 \, m$

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