GREENLAWNS SCHOOL, WORLI
Terminal Examination 2016
PHYSICS

STD: VIII Marks: 80
Date: 03/10/2016 Time : 2hrs

Question 1

a. Name the SI unit of: [2]

(i) Linear momentum.

(ii) Rate of change of momentum.

b. Why does the electric fan continue to rotate for sometime after the current is switched off? [2]

c. A body is dropped from the top of a tower. It acquires a velocity 20 m s^{-1} on reaching the ground. Calculate the height of the tower.(Take g = 10 m s^{-2}) [2]

d. What is back-lash error? How is it avoided? [2]

e. Give on example in each case where: i. the force is of contact and ii. Force is at a distance. [2]

Question 2

a. Draw a graph showing the relationship between acceleration and mass for a constant force. [2]

b. What is the force of gravity acting on body of mass 12 kg in kgf and newton? (g = 10 ms^{-2}) [2]

c. A body of mass 1.50 kg. is dropped from the 2^{nd} floor of a building which is at a height of 12 m. What is the force acting on it during its fall? (g = 9.8 m/s^2). [2]

d. A second's pendulum is taken to a planet where the acceleration due to gravity is four times that on the earth. What would he the time period of the pendulum on the planet? [2]

e. State the factors on which the magnitude of non contact force depends. How does it depend on the factors stated by you [2]

Question 3

a. Which is greater, the attraction of the earth for 1 kg of iron or attraction of 1 kg irons for the earth [2]

b. State two properties that a chosen unit should have for measurement. [2]

c. Mention any two differences between the mass and weight of a body. [2]

d. State any four guidelines for writing units [4]

Question 4

a. Why does an athlete run a certain distance before taking a long jump? [2]

b. State Newton's third law of motion with one suitable example. [2]

c. How long would a force of 30 N act on a body of mass 10 kg so that the body gains a velocity of 24 in s^{-1}? [2]

d. The weights of two bodies are 2.0 N and 2.0 kgf respectively. What is the mass of each body? ($g = 10\ m\ s^{-2}$) [2]

e. Complete the following

i. 1 a.m.u = _____kg ii.1meter = _____microns [2]

Question 5

a. Define newton, the SI; unit of force. Derive its relationship with the CGS unit of force.[3]

b. Mention the action and reaction in the following cases:

(i) a brick lying on the ground (ii) firing of a bullet from a gun

(iii) a person hammering a nail [3]

c. i. A girl is swinging in a swing in a sitting position. How will the period of the swing be affected if she stands up?

ii. The bob of an oscillating pendulum is made of ice. How will the time period change if the ice starts melting?

iii. Will a pendulum gain or lose time, when taken to a mountain?

iv. Why does simple pendulum eventually stop? [4]

Question 6

a. What do you mean by order of magnitude of a physical quantity? Give two examples. [3]

b. If time-displacement graph for a particle is a straight line parallel to the time-axis, what will be the velocity of the particle? Can time-displacement graph be perpendicular to the time-axis? Give reason for your answer [3]

c. A ball is thrown vertically upwards with an initial velocity of 50 m/s. Draw velocity-time graph and calculates

(i) The maximum height attained,

(ii) The time taken by it before it reaches the ground again,(Take $g = 10\ m\ s^{-2}$).[4]

Question 7

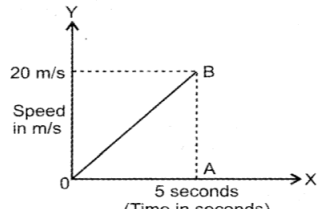
a. When a small cylinder is held just tight between the jaws of a vernier, the reading on the main scale is 5.3 cm and the 8th division of the vernier coincides with the main scale division. The main scale is graduated in mm and 10 divisions of vernier coincide with 9 main scale divisions. Find the length of the cylinder. [3]

b. State Newton's second law of motion both in words and in equation form. Under what condition does this equation become $F = ma$? [3]

c. What do you understand by the term acceleration due to gravity? How does the acceleration due to gravity change (i) from equator to poles (ii) above the surface of the earth and (iii) below the surface of the earth? [4]

Question 8

a. The speed-time graph of a moving car is shown in the figure below:



Calculate:

(i) The distance covered by the car in 5 seconds.

(ii) The acceleration of the car. [3]

b. When a micrometer screw gauge is used to find the thickness of a glass plate, following observations were taken:

Pitch of the screw = 1 mm

Number of divisions on circular scale = 100

Reading on the main scale = 0.3 cm

Reading on the circular scale = 47th division

Find the thickness of the glass plate. [3]

c. Obtain the equations of motion of a body moving with uniform acceleration. [4]

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Answer key

Question 1

a. Name the SI unit of: [2]

(i) Linear momentum.

(ii) Rate of change of momentum.

Ans. (i) kg m/s or Ns.

(ii) kg m/s^2 or N.

b. Why does the electric fan continue to rotate for sometime after the current is switched off? [2]

Ans. The electric fan continues to rotate due to inertia of motion, until the friction in bearings and that of air brings it to state of rest.

c. A body is dropped from the top of a tower. It acquires a velocity 20 m s^{-1} on reaching the ground. Calculate the height of the tower.(Take g = 10 m s^{-2}) [2]

Ans. According to Cartesian convention, $u = 0$, $v = -20$ m/s $g = -10\ m/s^2$ $h = ?$

$v^2 = u^2 + 2gh$

$(-20\ m/s)^2 = (0)^0 + 2(-10\ m/s^2)\ h$

$400\ m^2/s^2 = -20\ m/s^2 \times h$

$h = \frac{400}{20}$ m = 20 m

Height of the tower is 20 m.

d. What is back-lash error? How is it avoided? [2]

Ans. Back-lash error is the error due to wear and tear of the threads of the screw due to which on reversing the direction of rotation of the thimble, the tip of the screw does not move in the opposite direction immediately but remains stationary for a part of rotation. To avoid back- lash error, rotate the screw in one direction only while taking the measurement.

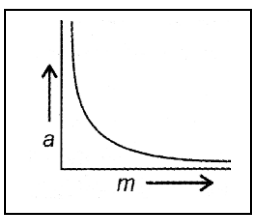
e. Give on example in each case where: i. the force is of contact and ii. Force is at a distance. [2]

Question 2

a. Draw a graph showing the relationship between acceleration and mass for a constant force. [2]

Ans. For a constant force F, acceleration, a is inversely proportional to mass m, i.e., $a \propto \frac{1}{m}$

Hence, the graph is



b. What is the force of gravity acting on body of mass 12 kg in kgf and newton? ($g = 10\ ms^{-2}$) [2]

Ans. Given : $m = 12$ kg $g = 10\ m/s^2$

$\therefore$ Weight of the body $w = mg = 12\ kg \times 10\ m/s^2 = 120$ N

Force acting on the body is the force of gravity which is equal to the weight of the body, i.e. 120 N. or 12 kgf

c. A body of mass 1.50 kg. is dropped from the 2nd floor of a building which is at a height of 12 m. What is the force acting on it during its fall? ($g = 9.8\ m/s^2$). [2]

Ans Rate of change of momentum = Force acting on the body during its fall = weight = mg

$= 1.50 \times 9.8 = 14.7$ N.

d. A second's pendulum is taken to a planet where the acceleration due to gravity is four times that on the earth. What would he the time period of the pendulum on the planet? [2]

Ans.

Given, $g_1 = g \quad g_2 = 4g \quad T_1 = 2\text{ s}, \quad T_2 = ?$

We know that $T \propto \frac{1}{\sqrt{g}}$

$$\frac{T_2}{T_1} = \sqrt{\frac{g_1}{g_2}} \; ; \quad \frac{T_2}{2\text{ s}} = \sqrt{\frac{g}{4g}}$$

$$T_2 = 2 \times \frac{1}{2} = 1\text{ s.}$$

e. State the factors on which the magnitude of non contact force depends. how does it depend on the factors stated by you [2]

Question 3

a. Which is greater, the attraction of the earth for 1 kg of iron or attraction of 1 kg irons for the earth [2]

Ans. The force of attraction between earth and 1 kg of iron is equal and opposite to the force of attraction between 1 kg of iron and the earth.

b. State two properties that a chosen unit should have for measurement. [2]

c. Mention any two differences between the mass and weight of a body. **[2]**

Ans.

Mass	*Weight*
(i) The mass is the quantity of matter contained in a body. (ii) It is a scalar quantity. (iii) It remains constant.	(i) Weight is the force with which a body is attracted towards the centre of the earth. (ii) It is a vector quantity

(iv) Its SI unit is kilogram. (v) Mass of a body is determined using a beam balance	(iii) It varies from place to place due to variation in the value of acceleration due to gravity. (iv) Its SI unit if newton (v) Weight of a body is determined using a spring balance.

d. State any four guidelines for writing units [4]

Question 4

a. Why does an athlete run a certain distance before taking a long jump? [2]

Ans An athlete runs a certain distance before taking a long jump. This is because if he runs through a certain distance before jump, the inertia of motion will help him in jumping over a longer distance.

b. State Newton's third law of motion with one suitable example. [2]

Ans. According to Newton's third law of motion, in an interaction between two bodies, if one body exerts a force on the second, the second body also exerts an equal and opposite force on the first i.e., to every action, there is always an equal and opposite reaction, e.g., if we consider two bodies 1 and 2, the body 1 exerts force F_{12} on body 2, simultaneously body 2 also exerts a force 1and 1 on body 1. Hence Newton's third law of motion can be expressed as $F_{12} = - F_{21.}$ Action and reaction forces always occur in pair and act on different bodies simultaneously

c. How long would a force of 30 N act on a body of mass 10 kg so that the body gains a velocity of 24 in s^{-1}? [2]

Ans

Given : $F = 30\ \text{N};\ m = 10\ \text{kg};\ u = 0,$
$v = 24\ \text{m s}^{-1};\ t = ?$

We know that $F = \dfrac{m\,(v-u)}{t}$

$$30\ \text{N} = \frac{10\ \text{kg}\ (24\ \text{m s}^{-1} - 0)}{t}$$

$$t = \frac{10 \times 24}{30}\ \text{s}$$

$$t = 8\ \text{s}.$$

d. The weights of two bodies are 2.0 N and 2.0 kgf respectively. What is the mass of each body? ($g = 10\ \text{m s}^{-2}$) [2]

Ans

Find Mass of the body of weight 2N = $\dfrac{2\text{N}}{10\ \text{m s}^{-2}}$ = 0.2 kg

Mass of the body of weight 2 kg f = 2 kg

e. Complete the following

i. 1 a.m.u = _____kg ii.1meter = _____microns [2]

Question 5

a. Define newton, the SI; unit of force. Derive its relationship with the CGS unit of force.[3]

Ans. 1 N is that force which produces an acceleration of 1 m/s^2 in a body of mass 1 kg.

1 N = 1 kg *x* 1 m/s^2

= *1000 g x 100* cm/s^2

= 10^5 g cm/s^2

$\therefore$ 1 N = 10^5 dyne.

b. Mention the action and reaction in the following cases:

(i) a brick lying on the ground (ii) firing of a bullet from a gun

(iii) a person hammering a nail [3]

Ans

Action	Reaction
(i) Weight of the brick acting on the ground in the downward direction. (ii) Forward motion of bullet (iii) Hammering	(i) upward force exerted by the ground on the brick (ii) recoiling of the gun (iii) movement of the nail

c. i. A girl is swinging in a swing in a sitting position. How will the period of the swing be affected if she stands up?

ii. The bob of an oscillating pendulum is made of ice. How will the time period change if the ice starts melting?

iii. Will a pendulum gain or lose time, when taken to a mountain?

iv. Why does simple pendulum eventually stop? [4]

Ans. i Case of a swinging girl can be considered as a simple pendulum. As the girl stands up in the centre of gravity of the bob is raised up, i.e., the length l of the pendulum decreases. Hence, the time period decreases.

ii. The time period will not be affected as it is independent of the mass of the bob.

iii When a pendulum is taken to the top, of a mountain, g will decreases. Therefore, it will increase, i.e., the pendulum will take more time to complete one oscillation. In other words, it will lose time.

iv Due to frictional resistance between air and bob, the amplitude of oscillation of the pendulum gradually decreases and eventually the pendulum stops.

Question 6

a. What do you mean by order of magnitude of a physical quantity? Give two examples.[3]

Ans. Order of magnitude of a physical quantity is the magnitude of the quantity in its nearest powers of 10.

Example :

(i) Mass of an electron = 9.1 x 10^{-31} kg

As the number 9.1 is in between 5 and 10 so it will be considered as 10 so its order of magnitude will be 10 x 10^{-31} = 10^{-30} kg.

(ii) Distance between the sun and the earth is 1.496 x 10" m.
Here 1.496 < 5, so it is taken as 1. So, its order of magnitude will be
$10^0 \times 10^{11} = 1 \times 10^{11} = 10^{11}$ m.

b. If time-displacement graph for a particle is a straight line parallel to the time-axis, what will be the velocity of the particle? Can time-displacement graph be perpendicular to the time-axis? Give reason for your answer [3]

Ans. If time-displacement graph for a particle is a straight line parallel to the time-axis, then the velocity of the particle will be zero, and is said to be at rest.
The displacement-time graph can never be a straight line parallel to displacement axis because it will represent that displacement of the object in a certain direction is increasing without increase in time, i.e., velocity is infinite which is impossible.

c. A ball is thrown vertically upwards with an initial velocity of 50 m/s. Draw velocity-time graph and calculates
(i) The maximum height attained,
(ii) The time taken by it before it reaches the ground again, (Take g = 10 m s^{-2}).[4]

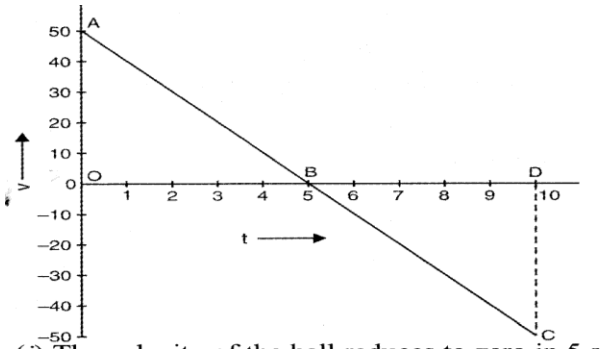
Ans. The initial velocity of the ball is 49 m/s which will be retarded at the rate of 9.8 m/s in every second after going up to the maximum height, the ball will stop for a moment and start returning under acceleration due to gravity. During the return journey its velocity will go on increasing by 9.8 m/s in every second.
Thus, using $v = u + gt$

(Given u = 49 m/s, g = 9.8 m/s^2, t = 0, 1, 2, ...)

t(s)	V (m/s)
0	50
1	40
2	30
3	20
4	10

t(s)	v (m/s)
5	0
6	10
7	20
8	30
9	40
10	50

Velocity-time graph is shown in the following figure. ,



(i) The velocity of the ball reduces to zero in 5 s The maximum height attained by the ball in 5 s

$$= \text{Area of } \Delta AOB$$

$$= \frac{1}{2} \times OA \times OB$$

$$= \frac{1}{2} \times 49 \times 5 = 122.5 \text{ m.}$$

(ii) From the graph it is clear that it takes 5 s to go to the maximum height and same time it takes to reach to the starting point. Hence, time taken by the ball before it reaches the ground = 5 s + 5 s = 10 s.

Question 7

a. When a small cylinder is held just tight between the jaws of a vernier, the reading on the main scale is 5.3 cm and the 8th division of the vernier coincides with the main scale division. The main scale is graduated in mm and 10 divisions of vernier coincide with 9 main scale divisions. Find the length of the cylinder. [3]

Ans. Given: s = 1 nun, n = 10
Least count of the vernier
= 1 mm/10 = 0.1 mm = 0.01 cm
length = 5.3 cm + 8 x 0.01 cm = 5.38 cm.

b. State Newton's second law of motion both in words and in equation form. Under what condition does this equation become F = ma? [3]

Ans. According to Newton's second law of motion, rate of change of momentum of a body is proportional to the external force acting on it and is in the direction of force.

$$\frac{dp}{dt} \propto F \quad \text{or} \quad \frac{dp}{dt} = F \qquad \ldots(1)$$

Where p stands for momentum and F for the force. Here, the constant of proportionality is taken as unity since this relation is used to define the unit of force.
If a force F is applied on a body of mass m, the velocity of the body changes in the direction of force, i.e. the acceleration (a) of the body is in the direction of force. Therefore, the equation (i) can be expressed in this form, i.e. F = ma, when the mass m of the body remains constant i.e., does not change with time.

c. What do you understand by the term acceleration due to gravity? How does the acceleration due to gravity change (i) from equator to poles (ii) above the surface of the earth and (iii) below the surface of the earth? [4]

Ans. When an object falls freely, its velocity increases constantly with time and hence is acted upon by a uniform acceleration.

Thus, the acceleration due to gravity is the acceleration of a freely falling object under the action of gravity of earth. It is represented by *g.* Its ST unit is m/s'. Its value changes from place to place.

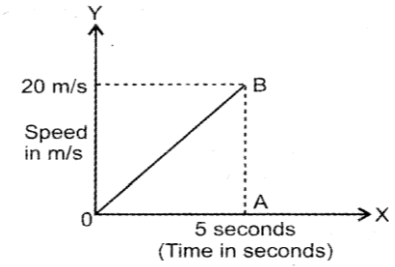
(i) From equator to poles its value increases

(ii) Decreases

(iii) Decreases.

Question 8

a. The speed-time graph of a moving car is shown in the figure below:



Calculate:

(i) the distance covered by the car in 5 seconds.

(ii) the acceleration of the car. [3]

Ans (i) The distance covered by the car in 5 seconds

= area of $\Delta OAB = \frac{1}{2}$ x 5 s x 20 m/s = 50 m

20 m/s — 0 m/s

(ii) The acceleration of the car = $\frac{20\ \text{m/s} - 0\ \text{m/s}}{(5-9)\text{s}}$

= 4 m/s^2

b. When a micrometer screw gauge is used to find the thickness of a glass plate, following observations were taken:

Pitch of the screw = 1 mm

Number of divisions on circular scale = 100

Reading on the main scale = 0.3 cm

Reading on the circular scale = 47th division

Find the thickness of the glass plate. [3]

Ans. Least count of the micrometer =

$$\frac{\text{Pitch}}{\text{Total number of divisions on circular scale}}$$

= 1 mm/100 = 0.01 mm = 0.001 cm

Thickness of the glass plate = MSR + CSD x ^{LC}

= 0.3 cm + 47 x 0.001 cm

= 0.347 cm.

c. Obtain the equations of motion of a body moving with uniform acceleration. [4]

Ans. Consider an object starting with initial velocity *u* and moving with a uniform acceleration *a* such that after time *t* it attains a velocity *v* and during time *t* its displacement is *s.*

To obtain $v = u + at$

We know that

$$\text{Acceleration} = \frac{change\ in\ velocity}{time\ interval}$$

$$a = \frac{v-u}{t} ;$$

$$v = u + at$$

To obtain $s = ut + \frac{1}{2}at^2$

We know that average velocity

$$= \frac{u+v}{2}$$

$\therefore$ s = average velocity x time

$$= \left(\frac{u+v}{2} \right) \quad x\ t = \frac{(u+u+at)}{2}\ x\ t$$

$$s = ut + \frac{1}{2}at^2$$

To obtain $v^2 = u^2 + 2as$

$$v = u + at$$

Squaring both sides

$$(v)^2 = (u + at)^2$$

$$v^2 = u^2 + 2uat + a^2t^2$$

$$= u^2 + 2a\ (ut + \frac{1}{2}at^2)$$

$$v^2 = u^2 + 2as.$$

$[\therefore ut + \frac{1}{2}at^2 = s]$