પુ•ના International School

Shree Swaminarayan Gurukul, Zundal

Annual Examination [2020 – 21]					
Student Name				**Grade**	**XI**
Date	**19/02/2021**			**Subject**	**Physics**
Set - A		**Time**	**3Hr**	**Total Marks**	**70**

General Instructions:

i. All questions are compulsory. There are 33 questions in all.
ii. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
iii. Section A contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, Section B has two case based questions of 4 marks each, Section C contains nine short answer questions of 2 marks each, Section D contains five short answer questions of 3 marks each and Section E contains three long answer questions of 5 marks each.
iv. There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions.

Section A

1. A lift is accelerated upward. Will the apparent weight of a person inside the lift increase, decrease or remain the same relative to its real weight? What will happen to the apparent weight if the lift moves with uniform speed?
2. Why can speed of a particle not be negative?

OR

Sameer went on his bike from Delhi to Gurgaon at a speed of 60km/hr and came back at a speed of 40km/hr. what is his average speed for entire journey.

3. How is angular momentum related to linear momentum?
4. How is the gravitational force between two point masses affected when they are dipped in water keeping the separation between them the same?

OR

Where does a body weight more; at the surface of the earth or in the mine?

5. Why does not the pressure of atmosphere break windows?
6. $\vec{A}$,$\vec{B}$ and $\vec{C}$ are three non-collinear, non-co-planar vectors. What can you say about direction of $\vec{A} \times (\vec{B} \times \vec{C})$?
7. Name some physical quantities which are dimensionless.

OR

Why do we have different units for same physical quantity?

8. How do wave Velocity and particle Velocity differ from each other?

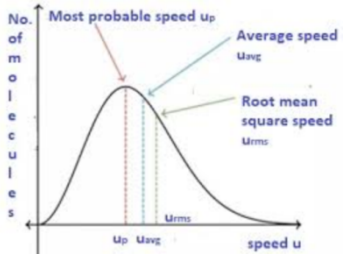
OR

The displacement of an elastic wave is given by the function $y=3\sin\omega t+4\cos\omega t$ where, y is in cm and t is in second. Calculate the resultant amplitude.

9. If air in a cylinder is suddenly compressed by a piston. What happens to the pressure of air?
10. What is motion in a plane?
11. **Assertion:** During a turn, the value of centripetal force should be less than the limiting frictional force.
    Reason: The centripetal force is provided by the frictional force between the tyres and the road.
    a. Assertion and reason both are correct statements and reason is correct explanation for assertion.
    b. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
    c. Assertion is correct statement but reason is wrong statement.
    d. Assertion is wrong statement but reason is correct statement.
12. **Assertion:** The strain produced in a stretched spring is shearing
    Reason: When spring is stretched, the length of wire of spring increases.
    a. Assertion and reason both are correct statements and reason is correct explanation for assertion.
    b. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
    c. Assertion is correct statement but reason is wrong statement.
    d. Assertion is wrong statement but reason is correct statement.
13. **Assertion:** P-T graph of all gases at low density meet at 0 K.
    Reason: Absolute zero kelvin is less than 0^{o}C in Celsius scale.
    a. Assertion and reason both are correct statements and reason is correct explanation for assertion.
    b. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
    c. Assertion is correct statement but reason is wrong statement.
    d. Assertion is wrong statement but reason is correct statement.
14. **Assertion:** If two bodies of equal masses undergo elastic collision in one dimension, then after the collision the bodies will exchange their velocities.
    Reason: In elastic collision, velocity of approach is equal and opposite of velocity of separation.
    a. Assertion and reason both are correct statements and reason is correct explanation for assertion.
    b. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
    c. Assertion is correct statement but reason is wrong statement.
    d. Assertion is wrong statement but reason is correct statement.

Section B

15. **Read the case study given below and answer any four subparts:**
    Root mean square velocity (RMS value)is the square root of the mean of squares of the velocity of individual gas molecules and the Average velocity is the arithmetic mean of the velocities of different molecules of a gas at a given temperature.



    i. Moon has no atmosphere because:-
        a. It is far away from the surface of the earth
        b. Its surface temperature is 10°C

c. The r.m.s. velocity of all the gas molecules is more than the escape velocity of the moon's surface
d. The escape velocity of the moon's surface is more than the r.m.s velocity of all molecules

ii. For an ideal gas, CP / CV is

a. >1
b. <1
c. ≤1≤1
d. none of these

iii. The root mean square velocity of hydrogen is 5–√5 times than that of nitrogen. If T is the temperature of the gas then:

a. $T(H_2) = T(N_2)$
b. $T(H_2) < T(N_2)$
c. $T(H_2) > T(N_2)$
d. none of these

iv. Suppose the temperature of the gas is tripled and N_2 molecules dissociate into an atom. Then what will be the rms speed of atom:

a. $v_0\sqrt{6}$
b. v_0
c. $v_0\sqrt{3}$
d. none of these

v. The velocities of the molecules are v, 2v, 3v, 4v & 5v. The rms speed will be:

a. 11 v
b. $v(11)^{12}$
c. v
d. $v(12)^{11}$

16. Read the case study given below and answer any four subparts:

All three states of matter (solid, liquid and gas) expand when heated. Thermal expansion can be defined as the change in the length, width, height, or volume of any material on changing the temperature. It is a well-known phenomenon now that substances expand on heating and contract on cooling

i. A pendulum clock shows the correct time at a definite temperature. At a higher temperature the clock

a. loses times
b. gain time
c. neither gains nor loses time
d. none of these

ii. Gaps are left between railway tracks because:

a. gaps hold the track firmly
b. gaps give the space to the tracks to expand in the summer
c. It is customary to leave the gap
d. none of these

iii. When a copper ball is heated, the largest percentage increase will occur in its:

a. Diameter
b. area
c. volume
d. all of the above

iv. Expansion during heating:

a. occurs only in solid
b. increase the weight of the material
c. decrease the density of the material
d. none of these

v. If the length of the cylinder on heating increases by 2 %, the area of the base will increase by:

a. 2%
b. 3%
c. 4%
d. 5%

Section C

17. If T be the period of a satellite revolving just above the surface of a planet, whose average density is ρρ, show that $\rho\rho T^2$ is a universal constant.

18. An object of mass 0.4kg moving with a velocity of 4m/s collides with another object of mass 0.6kg moving in same direction with a velocity of 2m/s. If the collision is perfectly inelastic, what is the loss of K.E. due to impact?

OR

A boy of mass 40 kg walks up a flight of stairs to a vertical distance of 12 m, in a time interval of 40 s.

i. At what rate is the boy doing work against the force of gravity?
ii. If energy is transformed by the leg muscles of the students at the rate of 30 kJ every minute, what is the students power output?

19. The length of a second's pendulum on the surface of Earth is 1 m. What will be the length of a second's pendulum on the moon?

OR

What are the two basic characteristics of a simple harmonic motion?

20. A bob of mass 0.1 kg hung from the ceiling of a room by a string 2 m long is set into oscillation. The speed of the bob at its mean position is 1 ms^{-1}. What is the trajectory of the bob if the string is cut when the bob is (a) at one of its extreme positions, (b) at its mean position?
21. Starting from a stationary position, a bus attains a velocity of 6 m/s in 30 s. Then, the driver of the bus applies a brake such that the velocity of the bus comes down to 4 m/s in the next 5 s. Calculate the acceleration of the bus in both cases.
22. State important characteristics of a mechanical wave motion.
23. If earth contracts to half its radius what would be the length of the day at equator?
24. Find the value of 60 J per min on a system that has 100 g, 100 cm and 1 min as the base units.

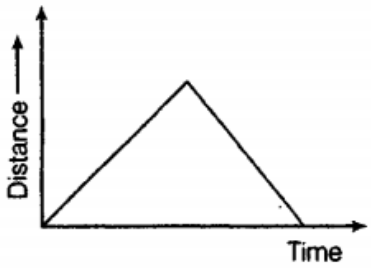
OR

A physical quantity P is related to four observables a, b, c and d as follows:

$P=a^3b^2 / (\sqrt{cd})$

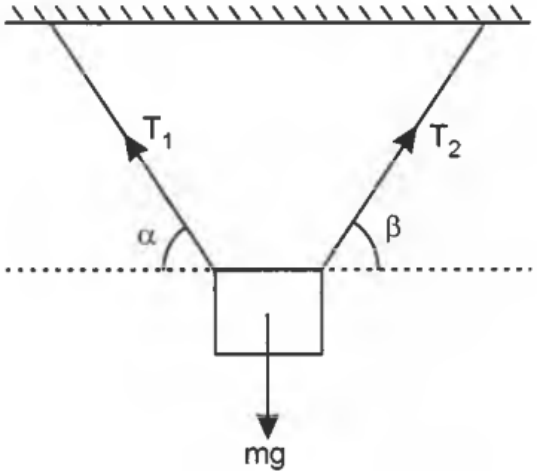
The percentage errors of measurement in a, b, c and d are 1%, 3%, 4% and 2%, respectively. What is the percentage error in the quantity P? If the value of P calculated using the above relation turns out to be 3.763, to what value should you round off the result?

25. The graph between total path length and time for a particle moving along a straight line as shown in figure is not possible. Explain why?



Section D

26. A body of mass m is suspended by two strings making angles α and β with the horizontal as shown in Figure. Calculate the tensions in the two strings.



27. Which of the following is the most precise device for measuring length:

a. a vernier callipers with 20 divisions on the sliding scale
b. a screw gauge of pitch 1 mm and 100 divisions on the circular scale
c. an optical instrument that can measure length to within a wavelength of light?

OR

One mole of an ideal gas at standard temperature and pressure occupies 22.4 L (molar volume). What is the ratio of molar volume to the atomic volume of one mole of hydrogen? (Take the size of hydrogen molecule to be about $1A^o$). Why is this ratio so large?

28. The range of a rifle bullet is 1000 m, when θ is the angle of projection. If the bullet is fired with the same angle from a car travelling at 36 km/h towards the target, show that the range will be increased by $142.9 \sqrt{\tan\theta}$ m.

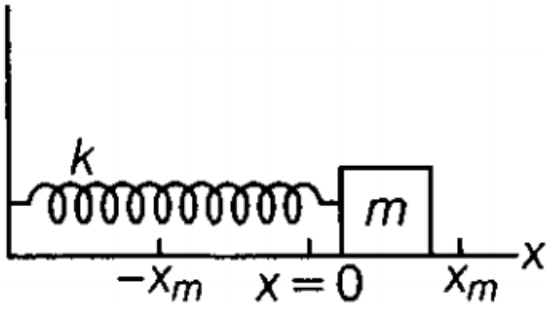
OR

At what point of projectile motion (i) potential energy maximum (ii) Kinetic energy maximum (iii) total mechanical energy is maximum?

29. The density of a solid at 0^0C and 500^0C is in the ratio 1.027 : 1. Find the co-efficient of linear expansion of the solid?
30. Assuming the earth to be a sphere of uniform mass density, how much would body weigh halfway down to the centre of the earth if it weighted 250 N on the surface?

Section E

31. Consider a block of mass 700 g is fastened to a spring having spring constant of 70 N/m. Find out the following parameters if block is pulled a distance of 14 cm from its mean position on a frictionless surface and released from rest at t =0.



i. The angular frequency, the frequency and the period of the resulting motion.
ii. The amplitude of the oscillation.
iii. The maximum speed of the oscillating block.
iv. The maximum acceleration of the block.
v. The phase constant and hence the displacement function x (t).

OR

Find the time period of mass M when displaced from its equilibrium positon and then released for the system shown.

32. An engine is attached to a wagon through a shock absorber of length 1.5 m. The system with a total mass of 50,000 kg is moving with a speed of 36 km/h when the brakes are applied to bring it to rest. In the process of the system being brought to rest, the spring of the shock absorber gets compressed by 1.0 m. If 90% of energy of the wagon is lost due to friction, calculate the spring constant.

OR

A rocket accelerates straight up by ejecting gas downwards. In a small time interval Δt, it ejects a gas of mass Δm at a relative speed u. Calculate KE of the entire system at (t+Δt) and t and show that the device that ejects gas does work =1/ 2Δmu^2 in this time interval (neglect gravity).

33. A steel rod of length 2 l, cross sectional area A and mass M is set rotating in a horizontal plane about an axis passing through the centre. If Y is the Young's modulus for steel, find the extension in the length of the rod. (Assume the rod is uniform.)

OR

Calculate the percentage increase in the length of a wire of diameter 2.5 mm stretched by a force of 100 kg weight. Young's modulus of elasticity of wire is 12.5×10^{11} dyne/sq cm.