

**CLASS – XI****General Instructions:**

- (1) There are 35 questions in all. All questions are compulsory
- (2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.
- (3) Section A contains eighteen MCQ of one (1) mark each, Section B contains seven questions of two (2) marks each, Section C contains five questions of three (3) marks each, section D contains three long questions of five (5) marks each and Section E contains two case study-based questions of 4 marks each.
- (4) There is no overall choice. However, an internal choice has been provided in section B, C, D and E. You have to attempt only one of the choices in such questions
- (5) Use of calculators is not allowed.

**(SECTION-A)**

- Q1. Two quantities A and B have different dimensions. Which mathematical operation may be physically meaningful?
- (a)  $A/B$  (b)  $A+B$   
(c)  $A-B$  (d)  $A = B$
- Q2. Two balls are dropped from heights  $h$  and  $3h$  respectively from the earth surface. The ratio of time of these balls to reach the earth is
- (a)  $1:\sqrt{3}$  (b)  $\sqrt{3}:1$   
(c)  $3:1$  (d)  $1:3$
- Q3. The angle between vectors  $\vec{a} = 10\hat{i} + 10\hat{j} - 5\hat{k}$  and  $\vec{b} = 8\hat{i} - 10\hat{j} + 10\hat{k}$  is
- (a)  $30^\circ$  (b)  $45^\circ$   
(c)  $60^\circ$  (d)  $90^\circ$
- Q4. The momentum of a system is conserved
- (a) Always  
(b) Never  
(c) In the absence of an external force on the system  
(d) None of the above
- Q5. A system consists of 3 particles each of mass  $m$  and located at  $(1, 1)$ ,  $(2, 2)$ ,  $(3, 3)$ . The co-ordinate of the centre of mass are
- (a)  $(6,6)$  (b)  $(3, 3)$   
(c)  $(2, 2)$  (d)  $(1, 1)$
- Q6. If radius of earth is  $R$  then the height ' $h$ ' at which value of ' $g$ ' becomes one-fourth is
- (a)  $R/4$  (b)  $3R/4$   
(c)  $R$  (d)  $R/8$
- Q7. Two wires of copper having the length in the ratio 4: 1 and their radii ratio

- as 1: 4 are stretched by the same force. The ratio of longitudinal strain in the two will be
- (a) 1:16 (b) 16:1  
(c) 1:64 (d) 64:1
- Q8. A boy while catching a ball, experiences an Impulse of 6 N s. If the mass of a ball is 200 g, what was a speed of a ball before it was caught?
- (a) 10 m/s (b) 20 m/s  
(c) 30 m/s (d) 40 m/s
- Q9. Water has maximum density at
- (a) 0°C (b) 32°F  
(c) - 4°C (d) 4°C
10. A force  $F=3i+c+2k$  acting on a particle causes a displacement  $S=4i+2j+3k$  in its own direction. If the work done is 6 J, then value of c is
- (a) 0 (b) 6  
(c) 1 (d) 12
11. A cycle tyre bursts suddenly. This represents an
- (a) Isothermal process (b) Isobaric process  
(c) Isochoric process (d) Adiabatic process
12. The moment of inertia of a body about a given axis is  $2.4 \text{ kgm}^2$ . To produce a rotational kinetic energy of 750 J, an angular acceleration of 5 rad/s must be applied about that axis for
- (a) 6 sec (b) 5 sec  
(c) 4 sec (d) 3 sec
13. The temperature at which the mot mean square velocity of a molecule will be doubled than at 100°C
- (a) 1219°C (b) 1492 k  
(c) 400°C (d) 400 K
14. The amplitude of a particle executing S.H.M. with frequency of 60 Hz is 0.01 m. The maximum value of the acceleration of the particle is
- (a)  $144\pi^2\text{m}/\text{sec}^2$  (b)  $144\text{m}/\text{sec}^2$   
(c)  $144 / \pi^2 \text{ m}/\text{s}^2$  (d)  $288\pi^2\text{m}/\text{sec}^2$
15. Two bodies of mass m and 4 m have equal kinetic energy. What is the ratio of their momentum?
- (a) 1:4 (b) 1:2  
(c) 1:1 (d) 2:1

**ASSERTION (A) AND REASON (R) TYPE QUESTION**

Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below

- If both Assertion A and Reason R are true and Reason R is the correct explanation of Assertion A
- If both Assertion A and Reason R are true and Reason R is NOT the correct explanation of Assertion A
- If Assertion A is true but Reason R is false
- If Assertion A is false and Reason R is also false

Q16. **ASSERTION:** A player lowers his hands while catching a cricket ball and suffers less reaction force

**REASON:** For the given momentum of the ball the reaction force inversely proportional to duration of catching time.

Q17. **ASSERTION:** The torque of a given force is maximum when the angle between force and position vector of the point where force is acting is  $90^\circ$ .

**REASON:** Torque and force both are the vector quantity.

Q18. **ASSERTION:** In isothermal process whole of the heat energy supplied to the body is converted into internal energy.

**REASON:** According to the first law of thermodynamics  $\Delta Q = \Delta U$

**SECTION B**

- Explain the effect of Temperature on viscosity of (a)Liquid (b)Gases.
- The sum and difference of two vectors are equal in magnitude. Show that they are mutually perpendicular to each other.

**OR**

Find the angle of projection in projectile motion for which horizontal range and maximum height are equal.

- State the number of significant figures of following-
  - 0.07m
  - 2.604km
  - 3.9040 N
  - $2.06 \times 10^{-9}$  N
- Escape velocity from a planet is  $V_e$ . If its mass is increased to 8 times and its radius is increased by 2 times, calculate the new escape velocity?
- What do you understand by isothermal process and adiabatic process ? Give an example of each?
- State four laws of limiting friction.
- Write Newton's formula for the speed of sound in air. Explain how is it

**SECTION C**

26. State the principle of superposition of waves. Show that only odd harmonics can be produced in air column with one end closed and other open.
27. A wire is fixed at one end and is subjected to increasing load at the other end. Draw a curve between stress and strain. With the help of the curve, explain the term elastic limit, yield point, breaking point and permanent set.
28. Using a proper labelled diagram Derive an expression for the centripetal acceleration of a body moving in a circular path of radius 'r' with uniform speed 'v'.
29. A packet is dropped from the balloon when situated at a height of 245m. How long does it take the packet to reach the ground? What is its final velocity. A balloon is ascending at the rate of 4.9m/s.?

**OR**

- A ball is dropped from a bridge of 122.5m high. After 2s, another ball is thrown straight down after it. What should be the initial velocity of the second ball so that both hit the water at the same time?
30. Light from the moon, is found to have a peak (or wavelength of maximum emission) at  $\lambda = 14 \mu\text{m}$ . Given that the Wien's constant b equals  $2.8988 \times 10^{-3} \text{ m K}$ , estimate the temperature of the moon.

**SECTION D**

31. (i) Draw velocity - time graph for uniformly accelerated motion. Obtain the three equations of motion graphically.
- (ii) A ball is thrown vertically upwards with a velocity of 20 m/s from the top of a building. The height of the point from where the ball is thrown is 25 m from the ground.
- (a) How high will the ball rise?
- (b) how long time will it takes before the ball hits the ground?
- (g= 10 m/s<sup>2</sup>)

**OR**

- (i) Define banking of road, and angle of friction.
- (ii) A body of mass 5 kg is sliding on a surface inclined at an angle 60° with the horizontal. Calculate the acceleration of the body and angle of friction. The coefficient of kinetic friction between the body and the surface is 0.5 and  $g = 10 \text{ ms}^{-2}$ .
- Q32. What is perfectly elastic collision? Obtain an expression for the final velocities for the bodies undergoing elastic collision in one dimension.

Also prove that if the masses are equal after collision the velocities get interchanged.

**OR**

- (i) State and prove Work-Energy Theorem?
  - (ii) If the momentum of a body increases by 10%, find how much percent its kinetic energy will increase?
- Q33. (i) State Stoke's law for the viscous drag experienced by the spherical body falling through a viscous liquid.
- (ii) Why does a spherical body achieve terminal speed?
  - (iii) On what factors does the terminal speed of a spherical body falling in a viscous medium depend?
  - (iv) Give one example each of motion around us with
    - (a) Positive terminal velocity
    - (b) Negative terminal velocity.

**OR**

- (A) State and prove Bernoulli's theorem with the help of a neat and labelled diagram.
- (B) It is advised not to stand near the edge of platform when the fast-moving train is approaching. Give reason

### **SECTION E**

34. **Case Study:** Read the following paragraph and answer the questions.

**Analogy Between Translational Motion and Rotational Motion:**

The translational motion is executed under the influence of a net force on body which causes to gain different physical quantities like displacement, velocity, acceleration, momentum etc. by body. Similarly, the rotational motion is executed under the influence of a net torque on body which causes to gain different physical quantities like angular displacement, angular velocity, angular acceleration, angular momentum etc. by body. So, we can observe that the quantities used in rotational motion are analogue of quantities used in translational motion.

- (i) What is rotational analogue of mass?
- (ii) Write a relation between torque and moment of inertia.
- (iii) Write the principle of conservation of angular momentum.

A fly wheel is revolving with a constant angular speed. A chip of its rim breaks and flies away. What will be the effect on its angular speed?

**OR**

On what factors moment of inertia depends?

What will happen to the moment of inertia of the Earth if it suddenly shrinks in volume (Mass remains same) ?

Q35. Read the paragraph carefully and answer the questions given below  
When we speak, the sound moves outward from us, without any flow of air from one part of the medium to another. The disturbances produced in air are much less obvious and only our ears or a microphone can detect them. These patterns, which move without the actual physical transfer or flow of matter as a whole, are called waves, The most familiar type of waves such as waves on a string, Water waves, sound waves, seismic waves, etc. is the so called mechanical waves. These waves require a medium for propagation, they cannot propagate through vacuum. They involve oscillations of constituent particles and depend on the elastic properties of the medium. Electromagnetic waves do not necessarily require a medium- they can travel through vacuum. Beats is an interesting phenomenon arising from interference of waves. When two harmonic Sound waves of slightly different frequencies and comparable amplitude are heard at the same time, we hear a sound of similar frequency (the average of two close frequencies), but we hear something else also. We hear audibly distinct waxing and waning of the intensity of the sound, with a frequency equal to the difference in the two close frequencies. Beat frequency is given by  
Artists use this phenomenon often while tuning their instruments with each other. They go on tuning until their sensitive ears do not detect any beats.

1. Air can sustain
  - (a) Transverse waves
  - (b) longitudinal waves
  - (c) Both a and b
  - (d) none of these
2. The electromagnetic waves can pass through.
  - (a) Solids only
  - (b) Fluids only
  - (c) Any medium even through vacuum
  - (d) None of these
3. Define beat in reference to sound waves.  
Write the expression for the beat frequency, when two waves of slightly different frequencies superimpose to form beats.

OR

Will there be a net flow of air from a room when a loud sound is made inside it?

Longitudinal wave can travel through?

- (a) Solids only
- (b) Liquids only
- (c) Gases only
- (d) Solids, Liquids, Gases

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