SET-B

No. of printed pages / Questions:6/33

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Class: XI
Subject: PHYSICS

MM: 70
Time: 3 Hrs

General instruction

(Fifteen minutes extra will be given for reading the question paper.)

- There are 33 questions in all. All questions are compulsory.
- This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
- All the sections are compulsory.
- Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study based questions of four marks each and Section E contains three long answer questions of five marks each.
- There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C and all three questions in Section E. You have to attempt only one of the choices in such questions.
- Use of calculators is not allowed.

SECTION A

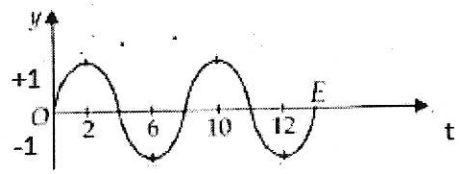
1.At temperature T, the rms velocity of Hydrogen molecule equal to that of Oxygen molecule which is at $47^{O}C$. The value of T is

(a)40K
(b)20K
(c)60K
(d)50K

2.The banking angle for a curved road of radius 450m for a vehicle moving at $35ms^{-1}$ is

(a)$\tan^{-1}(0.25)$
(b) $\tan^{-1}(0.55)$
(c) $\tan^{-1}(0.45)1$
(d) $\tan^{-1}(0.75)$

3.The x-t graph of a particle undergoing simple harmonic motion is as shown in the figure . The acceleration of a particle at t=4/3 sec is



(a) $\sqrt{3}\pi^2/32\ cms^{-2}$
(b)$\pi^2/32\ cms^{-2}$
(c)$-\pi^2/32 cms^{-2}$
(d) $\sqrt{3}\pi^2/32\ cms^{-2}$

4.A black body at 2000K, emits maximum energy at wavelength of 1.56μm. At what temperature will it emit maximum energy at a wavelength of 1.8μm?

(a)1380K
(b)1650K
(c)1729K
(d)1800K

5.The possibility of increase in temperature of gas without adding heat to it happens in

(a)adiabatic expansion (b)Isothermal Expansion

(c) adiabatic compression (d) Isothermal compression

6.For diatomic rigid molecules ratio of specific heats is γ

(a)7/5 (b)5/3

(c)9/5 (d)3/2

7.The kinetic energy of 23gm of NO_2 gas at 27^O C is

(a) Zero (b)10.015kJ

(c)18.706kJ (d)50.157kJ

8.The energy associated with each degree of freedom of a gas molecule is

(a)Zero (b)KT/2

(c)KT (d)KT/3

9. The moment of inertia of a solid sphere of uniformly distributed mass of M kg and radius R about center of mass is

(a) $3MR^2/4$ (b) $MR^2/8$

(c) $2MR^2/5$ (d) MR^2

10.The Centre of mass of a semi circular disc of uniform mass distribution having radius R is

(a)$2R/\pi$ (c)$\pi/2R$

(c)$4R/3\pi$ (d)$3\pi/4R$

11.A lift having mass 100 kg is rising up with an acceleration 4 m/s2. The tension in the string is

(a)1380N (b)1160N

(c) 2380N (d)580N

12.If, $A= 2\hat{i} +3\hat{j}$ and $B = \hat{i}+ j$, find the component of A along B is

(a)$5/\sqrt{2}$ (b)$3/\sqrt{2}$

(c)$1/\sqrt{2}$ (d)$\sqrt{2}$

For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below.

a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.

b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

c) If Assertion is true but Reason is false.

d) If both Assertion and Reason are false.

13. Assertion: Centripetal acceleration is always directed towards the centre of rotation of an object undergoing uniform circular motion.

Reason : Centripetal acceleration is a constant vector .

14. Assertion : Every periodic motion is not simple harmonic Motion

Reason : The motion governed by force law ,F=-kx

15. Assertion: The centre of mass of body may lie where there is no mass
Reason: The centre of mass has nothing to do with the mass.

16. Assertion: A projectile should have two component velocities in two mutually perpendicular directions
Reason : A body is said to be in projectile if it has motion in two dimension

SECTION B

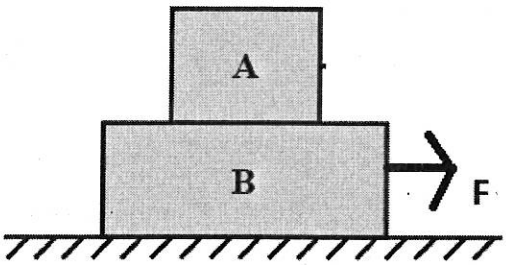
17. Length of the wire at room temperature is 4.55. When the temperature increases up to $100^{o}C$ then its length becomes 4.75m . Find coefficient of linear expansion (α) of the given wire.

18. When 1.5kg of ice at 0oc mixed with 2 kg of water at $70^{o}C$ in a container the resulting temperature is $5^{o}C$, the calculate the heat of fusion of ice. Specific heat capacity of water $=4186\ J\ kg^{-1}\ K^{-1}$.

OR

Two bars of length L and 3L having same cross sectional areas but of different thermal conductivities K and 2K joined in series. One end of resultant bar is at tempreture $100^{o}C$ and other end at $0^{o}C$. Find temperature of junction.

19. In the figure , the coefficient of friction between the floor and the block B is 0.1. The coefficient of friction between the blocks B and A is 0.2. The mass of A is 1 kg and B is 0.2 . The mass of A is 1kg and B is 2kg. What is maximum horizontal force F which can be applied to block B so that two blocks moves together?



20. What are the condition for Action –Reaction pairs of forces?

21.(i)Write dimensional formula of Torque.
(ii)A ball is thrown vertically upwards with a velocity of 20 ms-1 from the top of a multi-storey building of 25m high. How high will the ball rise?(Take $g= 10\ ms^{-2}$)

SECTION C

22.(i)The triple points of neon and carbon dioxide gas are 24.57K and 216.55K respectively . Express these temperature on Celsius and Fahrenheit scales.
(ii)Consider a compound slab consisting of two different materials having equal thickness and thermal conductivities K and 2K respectively connected in series .Find the equivalent conductivity of slab.

23.(i)Write any three postulates of kinetic theory of gases.
(ii)What is change in internal energy of a system over one complete cycle of any cyclic process?

(iii)At what temp average kinetic energy of the molecules of ideal gas will be twice their kinetic energy at $20^{o}C$

24. Derive that formula for gravitational potential energy between two masses m_1 and m_2 separated by r distance is given by $U=-Gm_1m_2/r$

25. The angular speed of a motor wheel is increased from 1200 rpm to 3120 rpm in 16second.
(i)What is its angular acceleration assuming the acceleration to be uniform?
(ii)How many revolution does the wheel make during this time.

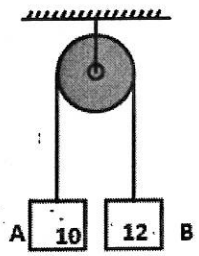
OR

Derive an expression for moment of inertia of a circular disc about an axis passing through its centre and perpendicular to its plane .

26. (i)What do you mean by law of conservation of energy? Prove it using suitable example.
(ii) Write two differences between Elastic and inelastic collision.

27. (i)Write two differences between static and kinetic friction .
(ii)What is isochoric process?

28.(i)What is the angle made by vector A=2i+2j with x axis?
(ii)The system starts from rest as shown in figure. What is the speed and distance moved by each mass (in kg) at t =3 seconds.



SECTION-D

29. Simple harmonic motion is the simplest form of oscillation. A particular type of periodic motion in which a particle moves to and fro repeatedly about a mean position under the influence of a restoring force is termed as simple harmonic motion (S.H.M).
A body is undergoing simple harmonic motion if it has an acceleration which is directed towards a fixed point, and proportional to the displacement of the body from that point.

Acceleration $a \propto -x \Rightarrow a = -kx$ or $\frac{d^2x}{dt^2} = -kx$,

(i)Which of the following is not a characteristic of simple harmonic motion?
(a) The motion is periodic.
(b) The motion is along a straight line about the mean position.
(c) The oscillations are responsible for the energy conversion.
(d) The acceleration of the particle is directed towards the extreme position.

(ii) The equation of motion of a simple harmonic motion is

(a) $\frac{d^2x}{dt^2} = -\omega^2 x$ (b) $\frac{d^2x}{dt^2} = -\omega^2 t$

(c) $\frac{d^2x}{dt^2} = -\omega x$ (d) $\frac{d^2x}{dt^2} = -\omega t$

(iii) Which of the following expressions does not represent simple harmonic motion?

(a) $x = A\cos wt + B\sin wt$ (b) $x = A\cos(wt + a)$

(c) $x = B\sin(wt + b)$ (d) $x = A\sin wt \cos^2 wt$

(iv)The time period of simple harmonic motion depends upon

(a) amplitude (b) energy

(c)Phase (d)mass

30. The rotational analogue of force in linear motion is moment of force. It is also referred to as torque or couple. If a force acts on a single particle at a point, whose position with respect to the origin is given by the position vector r, the moment of the force acting on the particle with respect to the origin is defined as the vector product $\tau = r \times F$.
The moment of force (or torque) is a vector quantity.
The magnitude of is

$$\tau = r F \sin\theta,$$

Where $r\sin\theta$ is the perpendicular distance of the line of action of F from the origin and F $\sin\theta$ is the component of F in the direction perpendicular to r. Note that $\tau = 0$ if $r = 0$, $F = 0$ or $\theta = 00$ or 180^0. Thus, the moment of a force vanishes if either the magnitude of the force is zero, or if the line of action of the force passes through the origin. With the help of above comprehension, choose the most appropriate alternative for each of the following questions:

(i) If directions of both r and F are reversed, the direction of the moment of force

(a) remains the same (b) Reverse in direction

(c) Becomes parallel to force applied. (d) Becomes parallel to position vector

(ii) The dimensional formula of torque is same as that of

(a)Angular momentum (b)Work

(c)Momentum (d)Force

(iii) Torque is maximum when the angle between F and r is

(a)0^O (b)180^O

(b)90^O (d)360^O

(iv) Wrench of longer arm is preferred because

(a) It produces maximum force (b) It produces maximum torque.

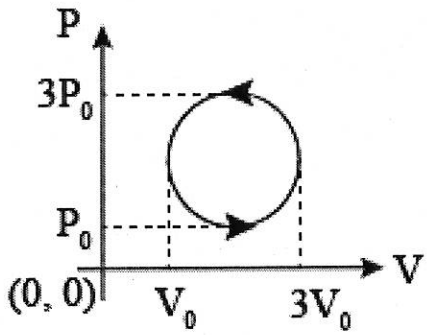
(c)It easy to hold (d)Wrench of shorter arm is equally good.

SECTION E

31. Derive formula of work done in adiabatic process.

OR

A cyclic process is shown in the figure.



Calculate

(i) work done during the cyclic process (in Joule).

(ii) change in internal energy.

(iii) Change in heat energy given or released by gas.

32. (i) What is central forces?

(ii) Define Escape velocity.

(iii) Derive and expression of escape velocity for an object from surface of earth.

OR

(i) The gravitational field intensity at a point 10000km from centre of earth is 4.8N/kg. Find the gravitational potential at that point.

(ii) Derive the expression of kinetic energy of a satellite revolving close the earth's surface.

33. (i) Differentiate between conservative and non conservative force.

(ii) Define work energy theorem and prove it.

OR

(i) A body of mass 1 kg, moving with velocity 10 m/s collide inelastically head-on with another body of mass 2 kg moving in the same direction. After the collision, the first body continues to move in the same direction with velocity 6 m/s. If e = 0.5, find the velocity of centre of mass of the two bodies after collision.

(ii) Define various types of equilibrium.

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