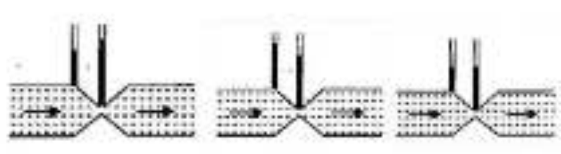
OSDAV Public School, Kaithal
December Exam- 2024-25
Class : XI
Subject : Physics

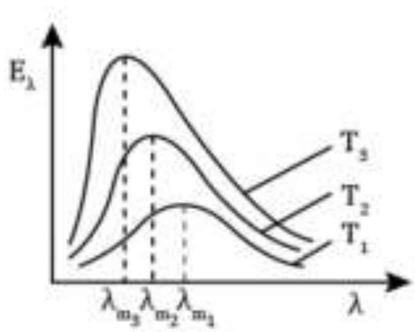
SET - A

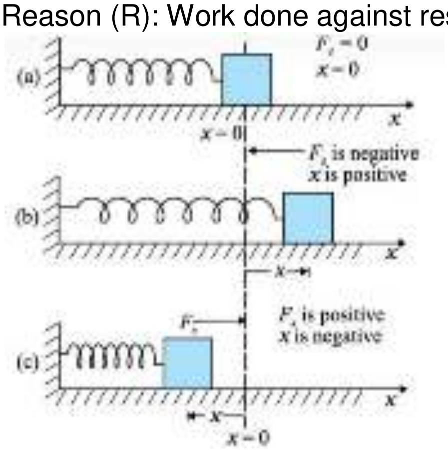
Time: 3 hr **M.M.: 70**

General Instructions:-

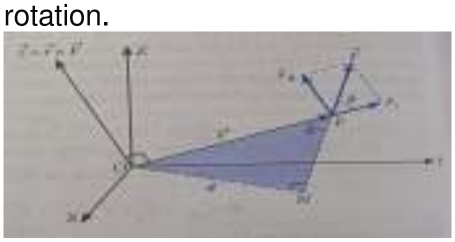
(1) ***There are 33 questions in all. All questions are compulsory.***
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 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.
(5) There is no overall choice.
(6) Use of calculators is not allowed.

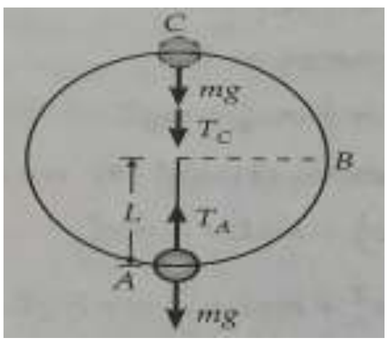
Q. No	**SECTION -A**	**Marks**
1	A source supplies heat to a system at the rate of 200 J/s. The system performs work at the rate of 80J/s. The internal energy of the system increases at the rate of (a) 80 J/s (b) 120 J/s (c) 200 J/s (d) 280 J/s	**1**
2	A body moves 6 m north, 8 m east & 10 m vertically Up, the resultant displacement is. (A) 14.14 m (B) 10 m. (C) 7.07 m. (D) 20 m	**1**
3	Figures A, B and C show study of flow of a non-viscous liquid. The correct figure is  (a) A only (b) B only (c) C only (d) B and C both	**1**
4	A steel ball is dropped in oil then: (A) The ball retains constant velocity after sometime. (B) The ball stops. (C) the speed of ball will keeping on increasing (D) none	**1**

5	Temperature of a black body increases from 327°C to 927°C. The initial energy is 2 kJ. What is the final energy? (A) 32 kJ (B) 320 kJ (C) 1200 kJ (D) None	**1**
6	There are two wires of same material and of same length while the diameter of second is two times the diameter of first wire then the ratio of extension produced in the wire by applying the same load will be: (A) 1:1 (B) 2:1 (C) 1:2 (D) 4:1	**1**
7	The angle between $\vec{A} = \hat{\imath} + \hat{\jmath}$ and $\vec{B} = \hat{\imath} - \hat{\jmath}$ is a)45 b) 90 c) 180 d) 0	**1**
8	Two bodies of masses m and 2m have equal kinetic energy. The ratio of their linear momentum is a)$1/\sqrt{2}$ b) 1/2 C) 1 d) 2	**1**
9	The graph shows variation of radiation energy emitted per unit area per unit wavelength by three black bodies at absolute temperaturesT_1 , $T_2$and T_3. The relation between T_1 , T_2 and T_3 is  (a) $T_1 > T_2 > T_3$ (b) $T_1 < T_2 < T_3$ (c) $T_1 > T_2 < T_3$ (d) $T_1 < T_2 > T_3$	**1**
10	A boy is rolling a 0.5 Kg ball on the frictionless floor with a speed of 20 m/s. The ball gets reflected by an obstacle. On the way after deflection it moves with 5% of its initial kinetic energy. What is the speed of the ball now (A) 4.47 m/s (B) 1.00 m/s (C) 14.14 m/s (D) 19 m/s	**1**
11	A spaceman in training is rotated in a seat at the end of a horizontal rotating of length 5 m. If he can with stand acceleration is up to 9g then what is the maximum number of revolutions per second permissible? (Take g = 10 m/s^2) (A) 13.5 rps (B) 1.35 rps (C) 0.675 rps (D) 6.75 rps	**1**

12	A body of mass 4m at rest explodes into three pieces. Two of the pieces each of mass m move with speed v each in mutually perpendicular directions .The total kinetic energy released is a) ½ mv^2 b) mv^2 c) 3/2 mv^2 d) 5/2 mv^2	**1**
	Q13 to 16 are Assertion Reason Questions. 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: *a) Both A and R are true and R is the correct explanation of A.* *b) Both A and R are true and R is NOT the correct explanation of A.* *c) A is true but R is false.* *d) A is false and R is also false.*	
13	Assertion (A):Two bodies at different temperatures $T_1$and T_2, when brought in thermal contact do not necessarily settle to same temperature $(T_1+T_2)/2$. Reason (R):Two bodies may have different thermal capacities.	**1**
14	Assertion: The ratio Cp/ Cv for a diatomic gas is more than that for a monoatomic gas. Reason: the molecules of a monatomic gas have more degrees of freedom than those of a diatomic gas.	**1**
15	Assertion: Bulk modulus of elasticity B represents incompressibility of the material. Reason: $B = -\Delta P/(\Delta V/V)$ where symbols have their usual meaning.	**1**
16	Assertion (A): In case (b) and (c) both springs possess same potential energy. Reason (R): Work done against restoring force is stored as Potential energy. 	**1**

	SECTION - B	
17	What is an Adiabatic process? Give two conditions for an adiabatic process to take place.	**2**
18	Two rods A and B made of different materials are of equal length L. Each rod has the ends at temperature T_1 and T_2 , where $T_1 > T_2$. Find the condition that will ensure equal rates of flow of heat through the rods A and B.	**2**
19	Derive an expression for kinetic energy of a body of mass m.	**2**
20	Calculate the r.m.s. velocity of oxygen molecules at S.T.P. The molecular weight of oxygen is 32.	**2**
21	What is the angle of projection for a projectile motion whose range R is n times the maximum height H?	**2**
	SECTION - C	
22	Justify the following statements a) It is possible to increase the temperature of a gas without adding heat to it. b) An ideal gas undergoes isothermal process from some initial state i to final state f, then the amount of heat absorbed is equal to work done. c) The velocity of water is greater in a narrow tube than in a broader tube, both lying horizontally	**3**
23	Derive an expression for the height of liquid raised in a capillary tube dipped vertically in a liquid which wets the walls of the capillary tube. Also justify that will liquid overflow if the identical capillary tube of length less than h is dipped vertically in liquid.	**3**
24	A 200 gram copper calorimeter contains 150 gram of oil at 20°C. To the oil is added 80 gram of aluminium at 300°C. What will be the temperature of system after equilibrium is established. Given that specific heat of copper = 0.3906 J/g°C, specific heat of aluminium = 0.882 J/g°C and specific heat of oil = 1.554 J/g°C.	**3**
25	Define escape velocity. Derive its expression and then write the relation between escape and orbital velocity.	**3**
26	Derive an expression for the pressure exerted by an ideal gas on the walls of container.	**3**
27	The rate of flow (V) of a liquid through a pipe of radius 'r' under a pressure gradient is given by the formula $V = \frac{\pi p r^4}{8\eta l}$,where η is the coefficient of viscosity. Check the dimensional correctness of the above relation. b) Show the variation of force of friction with applied force graphically.	**3**
28	Prove that magnitude of the ratio of difference in speeds after collision, to the difference in speeds before collision, for one – dimensional elastic collision is equal to one.	**3**

	SECTION - D	
29	The property due to which the free surface of liquid tends to have the minimum surface area and behaves like a stretched membrane is called surface tension. It is a force per unit length acting in the plane of interface between the liquid and the bounding surface i.e., S = F/L, where F = force acting on either side of an imaginary line on the surface and L = length of the imaginary line. **(i)** The excess pressure inside a soap bubble is three times than excess pressure inside a second soap bubble, then the ratio of their surface area is (a) 9 : 1 (b) 1 : 3 (c) 1 : 9 (d) 3 : 1 **(ii)** Which of the following statements is not true about surface tension? (a) A small liquid drop takes spherical shape due to surface tension. (b) Surface tension is a vector quantity. (c) Surface tension of liquid is a molecular phenomenon. (d) Surface tension of liquid depends on length but not on the area **(iii)** Which of the following statement is not true about the angle of contact? (a) The value of the angle of contact for pure water and glass is zero. (b) Angle of contact increases with an increase in the temperature of the liquid. (c) If the angle of contact between a liquid and a solid surface is less than 90°, then the liquid spreads on the surface of the solid. (d) Angle of contact depends upon the inclination of the solid surface to the liquid surface. **(iv)** A liquid does not wet the solid surface if the angle of contact is (a) 0° (b) equal to 45° (c) equal to 90° (d) greater than 90°	**4**
30	The turning effect of force is called moment of force or torque. It is measured as product of the magnitude of the force and prependicular distance between the line of action of force and axis of rotation.  $\vec{T} = \vec{r} \times \vec{F}$ The direction of torque is perpendicular to the plane of r and F and its sense is given by right hand thumb rule . **(i)**Turning effect of force is produced by (a) Tangential component of Force (b) radial component of force (C) Transverse component of force (d) none of these **(ii)** Find the torque of force F = -3i + j + 5k acting at the point r = 7i + 3j + k (a) 14i - 38j + 16k (b) 4i + 4j + 6k (c) -14i + 38j - 16k (d) -21i +3j + 5k **(iii)** In order to balance a see saw of total length 10m, two kids weighing 20kg and 40 kg are sitting at an end and at a distance x from the fulcrum at centre, respectively.The value x(in cm) is (a) 125 (b) 250 (c) 450 (d) 350 **(iv**) A uniform rod of length L and mass 1.8 kg is made to rest on two measuring scales at its two ends. A uniform block of mass 2.7 kg is placed on the rod at distance of L/4 from the left end. The force experienced by measuring scale on right end is (a) 16 N (b) 27 N (c) 29 N (d) 45 N	**4**

	SECTION - E	
31	a) Find the percentage decrease in the weight of a body when taken to a height of 32 Km above the surface of earth. b) A ball is dropped from a height of 100m on a floor. At each collision with the floor the ball loses one tenth of its speed. Plot speed- time graph of its motion between t=0 to t=9s. (take $g=10m/s^2$)	**5**
32	A bob of mass m is suspended by a light string of length L. It is imparted a horizontal velocity v_o at the lowest point A such that it completes a semi-circular trajectory in the vertical plane with the string becoming slack only on reaching the topmost point, C.This is shown in figure. Obtain an expression for (i)v_o ; (ii) the speeds at points B and C; (iii) the ratio of the kinetic energies (K_B/k_c) at B and C. Comment on the nature of the trajectory of the bob after it reaches the point C.  	**5**
33	a) State and prove Bernoulli's theorem. b) A helicopter of mass 2×10^4kg has total wing area 400 m^2 and flying horizontally with the average speed of 250m/s. (a) Find the pressure difference between the lower and upper surface of the wings and (b) velocity difference between upper and lower surface of the wings. Given density of air = 1.3 kg/m^3, $g=10m/s^2$.	**5**

Answer Key
Physics XI [Set -A]

1	**B**	
2	**A**	
3	**B**	
4	**A**	
5	**A**	
6	**D**	
7	**B**	
8	**A**	
9	**B**	
10	**A**	
11	**C**	
12	**C**	
13	**A**	
14	**D**	
15	**A**	
16	**A**	
17.	**A thermodynamic process where no heat is exchanged between a system and its surroundings.** **Condition-** **The system must be perfectly insulated from the surrounding.** **The process must be carried out quickly.**	
18	$\frac{\Delta Q}{\Delta t} = KA\frac{\Delta T}{\Delta x}$ As , $\frac{\Delta Q_1}{\Delta t} = \frac{\Delta Q_2}{\Delta t}$ $K_1 A_1 \frac{(T_1 - T_2)}{L} = \frac{K_2 A_2 (T_1 - T_2)}{L}$ $\therefore \frac{A_1}{A_2} = \frac{K_2}{K_1}$	

19	Derivation only	
20	$\sqrt{(3RT/M)}$ $\sqrt{(3*8.314*273.15/32*10^3)}$ = 461.23	
21	$u^2 \sin 2Q/g = nu^2 \sin^2 Q/2g$ $u^2 2\sin Q\cos Q = nu^2 \sin^2 Q/2$ 4/n = tanQ Q = tan-1(4/n)	
22	(i) It is possible to increase the temperature of a gas without adding heat to it, during adiabatic compression the temperature of a gas increases while no heat is given to it. (ii) Yes, the amount of heat absorbed is equal to the work done when an ideal gas undergoes an isothermal process (iii) When water flowing in broader pipe enters a narrow pipe the area of cross-section of the water decreases therefore the velocity of water increases.	
23	Derivation only	
24	$M_1C_1\Delta T + M_2C_2\Delta T = M_3C_3\Delta T$ (200*0.3906 + 150*1.554)(T - 20) = 80*0.882*(300 - T) (78.12 + 233.1)(T - 20) = 70.56(300 - T) 311.22(T - 20) = 70.56(300 - T) 4.4(T - 20) = 300 - T 4.4T - 88 = 300 - T 5.4T = 388 T = 71.85°C	
25	Derivation only	
26	Derivation only	

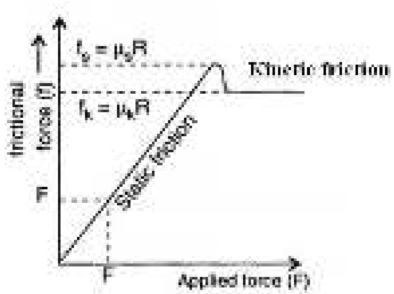
<table>
<tr><td>27</td><td>L.H.S. = V = $[L^3 T^{-1}]$

R.H.S. = $\frac{\pi}{8}\frac{\rho r^4}{\eta l}$

$= \frac{[M^1L^{-1}T^{-2}]}{[M^1L^{-1}T^{-1}]}\frac{[L]^4}{[L]^1}$

$= [M^0L^3 T^{-1}]$

As LHS = RHS, dimensionally
∴ The relation is correct


</td><td></td></tr>
<tr><td>28</td><td>Derivation only</td><td></td></tr>
<tr><td>29</td><td>(i) C
(ii) B
(iii) D
(iv) D</td><td></td></tr>
<tr><td>30</td><td>i) A
(ii) C
(iii) B
(iv) A</td><td></td></tr>
<tr><td>31</td><td>(A). d= 32 km R= 6400 km
weight of body at depth d is mg=mg(1-d/R)%
decrease in weight =(mg- mg`)/mg × 100= 32 / 6400×100 = 0.5%.

(B). v^2-0^2= 2*10*100
$v^2=\sqrt{2000}$
v= 44.72 m/s
Using. s=ut+1/2at^2
S= ½(0)t^2
$t^2=\sqrt{20}$
t=4.472 sec
Rebound velocity= (1-1/10)*44.72</td><td></td></tr>
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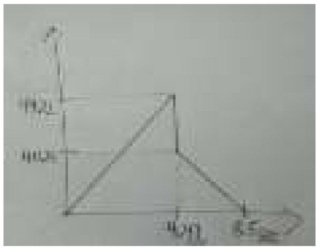
V= 9/10*44.72 = 40.24 m/s
Time taken to reach highest point = 4.024 sec
Total time taken = 4.472 + 4.024
= 8.5 sec
Graph



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<tr><td>32</td><td>

At A, $E = \frac{1}{2}mv_0^2 \ldots$(i)

The necessary centripetal force mv_0^2/L is provided by $(T_A - mg)$.

$T_A - mg = \frac{mv_0^2}{L} \ldots$(ii)

At the highest point C, the string slackens as the tension in the string (T_c) becomes zero.

$\therefore$ At C, $mg = \frac{mv_C^2}{L} \ldots$(iii)

and total energy, $E = \frac{1}{2}mv_C^2 + mg(2L) \ldots$(iv)

From (iii), $v_C = \sqrt{gL} \ldots$(v)

From (iv), $E = \frac{1}{2}m(gL) + 2mgL = \frac{5}{2}mgL$

Using (i), $\frac{1}{2}mv_0^2 = \frac{5}{2}mgL$, $v_0 = \sqrt{5gL} \ldots$(vi)

At B, the energy is $E = \frac{1}{2}mv_B^2 + mg(L)$

or $\frac{1}{2}mv_B^2 = E - mg(L) = \frac{5}{2}mgL - mgL$

$= \frac{3}{2}mgL$

$v_B = \sqrt{3gL}$

$\frac{K_B}{K_C} = \frac{\frac{1}{2}mv_B^2}{\frac{1}{2}mv_C^2} = \frac{3gL}{gL} = \frac{3}{1}$

At C, the string becomes slack and the velocity of the bob is horizontal and to the left. Therefore, the bob will continue on its circular path and complete the revolution.

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33	(A). Derivations only (B). $M=2*10^4$ kg. $A = 400m^2$. V = 250 m/s P1 - P2 = 1/2 rho($v2^2$- $v1^2$) mg/A = ½(1.3)(v2 - v1)(v2 + v1) $2*10^4*10/400*250*1.3$ = v2 - v1 By solving v2 - v1 = 1.538 m/s P1 - P2 = 500	

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SET - B

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(5) There is no overall choice.
(6) Use of calculators is not allowed.

Q. No	SECTION -A	Marks
1	A diatomoic gas does 100J of work when it is expanded isobarically. The heat given to the gas during this process is (a)700 J (b) 350 J (c) 175 J (d) 1050 J	1
2	A body moves 6 m north, 8 m east & 10 m vertically Up, the resultant displacement is. (A) 14.14 m (B) 10 m (C) 7.07 m (D) 20 m	1
3	The required kinetic energy of an object of mass m so that it may escape, will be (a) ¼ mgr b) ½ mgr c) mgr d) 2 mgr	1
4	18. A sphere of mass m and radius r is falling in the column of a viscous fluid. Terminal velocity attained by falling object is proportional to (a) r^2 (b) 1/r (c) - 1/ r^2 (d) r	1
5	There are two wires of same material and of same length while the diameter of second is two times the diameter of first wire then the ratio of extension produced in the wire by applying the same load will be: (A) 1:1 (B) 2:1 (C) 1:2 (D) 4:1	1
6	A small toy starts moving from the position of rest under a constant acceleration. If it travels a distance of 10 m in t s, the distance travelled by the toy in the next t s will be a)10 m b) 20 m c) 30 m d) 40 m	1

7	Two bodies of equal masses m and 2m have equal kinetic energy. The ratio of their linear momentum is a)$1/\sqrt{2}$ b) 1/2 C) 1 d) 2	**1**
8	A boy is rolling a 0.5 Kg ball on the frictionless floor with a speed of 20 m/s. The ball gets reflected by an obstacle. On the way after deflection it moves with 5% of its initial kinetic energy. What is the speed of the ball now (A) 4.47 m/s (B) 1.00 m/s (C) 14.14 m/s (D) 19 m/s	**1**
9	A spaceman in training is rotated in a seat at the end of a horizontal rotating of length 5 m. If he can with stand acceleration is up to 9g then what is the maximum number of revolutions per second permissible? (Take g = 10 m/s^2) (A) 13.5 rps (B) 1.35 rps (C) 0.675 rps (D) 6.75 rps	**1**
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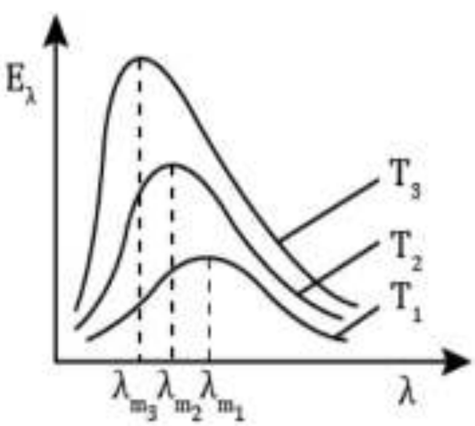
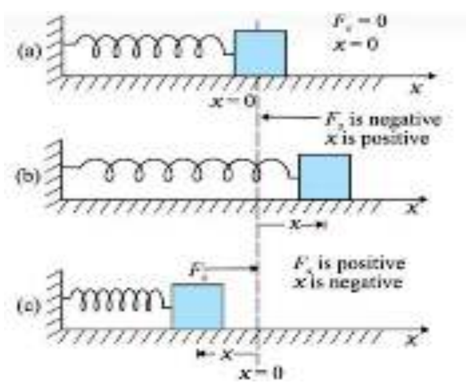
11	The graph shows variation of radiation energy emitted per unit area per unit wavelength by three black bodies at absolute temperatures T_1 , T_2 and T_3. The relation between T_1 , T_2 and T_3 is  (a) $T_1 > T_2 > T_3$ (b) $T_1 < T_2 < T_3$ (c) $T_1 > T_2 < T_3$ (d) $T_1 < T_2 > T_3$	**1**
12	Temperature of a black body increases from 327°C to 927°C. The initial energy is 2 kJ. What is the final energy? (A) 32 kJ (B) 320 kJ (C) 1200 kJ (D) None	**1**

	Q13 to 16 are Assertion Reason Questions. 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: *a) Both A and R are true and R is the correct explanation of A.* *b) Both A and R are true and R is NOT the correct explanation of A.* *c) A is true but R is false.* *d) A is false and R is also false.*	
13	Assertion : At the centre of earth a body neither has centre of mass nor centre of gravity. Reason : This is because of gravity at the centre of earth.	
14	Assertion : Lead is more elastic than rubber. Reason : If same load is loaded on the lead and rubber wire of same cross-sectional area, the strain of lead is very much less than that of rubber.	
15	Assertion (A): In case (b) and (c) both springs possess same potential energy. Reason (R): Work done against restoring force is stored as Potential energy. 	**1**
16	Assertion (A):Two bodies at different temperatures $T_1$and T_2, when brought in thermal contact necessarily settle to same temperature $(T_1+T_2)/2$. Reason (R):Two bodies can not have different thermal capacities.	**1**
	SECTION - B	
17	Give analytical treatment to find the magnitude of resultant vector by using parallelogram law of vector addition.	**2**
18	State and prove work energy theorem for a variable force.	**2**
19	What is an isothermal process? Give two conditions for an isothermal process to take place.	**2**
20	A Cricketer can throw a ball to a maximum horizontal distance of 100 m. How high above the ground can the cricketer throw the same ball?	**2**

21	Two rods A and B made of different materials are of equal length L. Each rod has the ends at temperature T_1 and T_2 , where $T_1 > T_2$. Find the condition that will ensure equal rates of flow of heat through the rods A and B.	**2**
	SECTION - C	
22	Justify the following statements a) It is possible to increase the temperature of a gas without adding heat to it. b) An ideal gas undergoes isothermal process from some initial state i to final state f, then the amount of heat absorbed is equal to work done. c) The velocity of water is greater in a narrow tube than in a broader tube, both lying horizontally.	**3**
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24	Define orbital velocity. Derive its expression and then write the relation between escape and orbital velocity.	**3**
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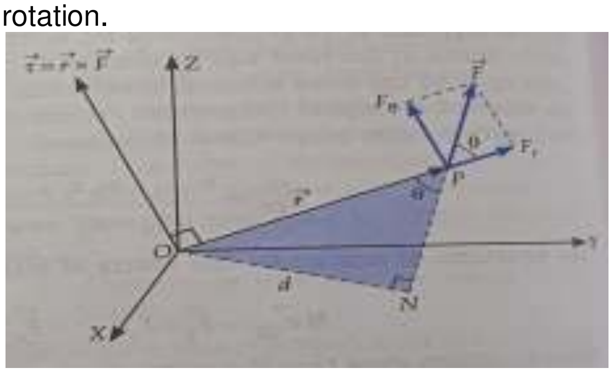
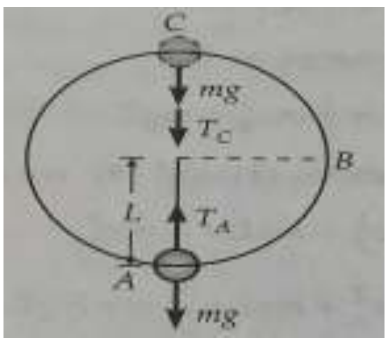
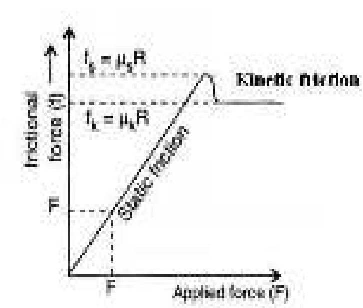
26	The rate of flow (V) of a liquid through a pipe of radius 'r' under a pressure gradient is given by the formula $V = \frac{\pi p r^4}{8 \eta l}$,where η is the coefficient of viscosity. Check the dimensional correctness of the above relation. b) Show the variation of force of friction with applied force graphically.	**3**
27	Prove that magnitude of the ratio of difference in speeds after collision, to the difference in speeds before collision, for one – dimensional elastic collision is equal to one.	**3**
28	A 200 gram copper calorimeter contains 150 gram of oil at 20°C. To the oil is added 80 gram of aluminium at 300°C. What will be the temperature of system after equilibrium is established. Given that specific heat of copper = 0.3906 J/g°C, specific heat of aluminium = 0.882 J/g°C and specific heat of oil = 1.554 J/g°C.	**3**
	SECTION - D	
29	When a body moves along a circular path with a uniform speed, its motion is said to be uniform circular motion. In uniform circular motion, the direction of the velocity vector which acts along the tangent to the path changes continuously but its magnitude (v = r*omega) always remains constant So uniform circular motion is an accelerated motion. A body undergoing uniform circular motion acted upon by an acceleration which is directed along the radius towards the centre of the circulaz path. This acceleration is called centripetal acceleration. The magnitude of the acceleration is a constant but the direction of acceleration changes continuously, always pointing towards the centre. So centripetal acceleration is not a constant vector. The resultant acceleration of a body in circular motion is towards the centre only if its speed is constant.	**4**

	(A) A body executing uniform circular motion has at any instant its velocity vector and acceleration vector (a) along the same direction (b) in opposite direction (c) normal to each other (d) not related to each other **(B)** The angular speed of a fly-wheel making 120 revolutions/minute is (a) π rad/sec (b) 2 π rad/sec (b) 4 π rad/sec (d) $4\pi^2$ rad/sec **(C)** A particle moves with constant speed v along a circular path of radius r and completes the circle in time T. The acceleration of the particle is (a)$(2\pi v)/T$ (b)$(2\pi r)/T$ (a)$(2\pi v^2)/T$ (b)$(2\pi r^2)/T$ **(D)** A stone tied to the end of a string 1 m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolutions in 44 sec, what is the magnitude and direction of acceleration of the stone? (a)$\pi^2/4$ m/s^2 and direction along the radius towards the centre (b) π^2 m/s^2 and direction along the radius away from the centre direction along the radius (c) π^2 m/s^2 and towards the centre (d) π^2 m/s^2 and direction along the tangent to the circle of Fall	
30	The turning effect of force is called moment of force or torque. It is measured as product of the magnitude of the force and prependicular distance between the line of action of force and axis of rotation.  T = r × F The direction of torque is perpendicular to the plane of r and F and its sense is given by right hand thumb rule .	**4**
	(A)Turning effect of force is produced by (a) Tangential component of Force (b) radial component of force (C) Transverse component of force (d) none of these (B) Find the torque of force F = -3i + j + 5k acting at the point r = 7i + 3j + k (a) 14i - 38j + 16k (b) 4i + 4j + 6k (c) -14i + 38j - 16k (d) -21i +3j + 5k (C) In order to balance a see saw of total length 10m, two kids weighing 20kg and 40 kg are sitting at an end and at a distance x from the fulcrum at centre, respectively.The value x(in cm) is (a) 125 (b) 250 (c) 450 (d) 350 (D) A uniform rod of length L and mass 1.8 kg is made to rest on two measuring scales at its two ends. A uniform block of mass 2.7 kg is placed on the road at distance of L/4 from the left end. The force experienced by measuring scale on right end is (a) 16 N (b) 27 N (c) 29 N (d) 45 N	

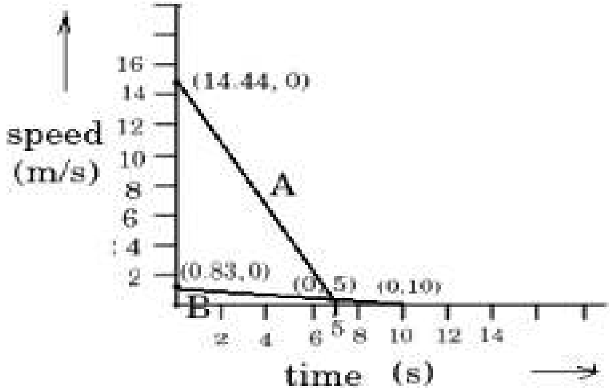
	SECTION - E	
31	a) Define terminal velocity. Derive terminal velocity v_T of a sphere of radius r, density σ falling vertically through a viscous fluid of density ʅ and coefficient of viscosity η .Use this formula to explain the observed rise of air bubbles in a liquid. b) A helicopter of mass 2×10^4kg has total wing area 400 m^2 and flying horizontally with the average speed of 250m/s. (a) Find the pressure difference between the lower and upper surface of the wings and (b) velocity difference between upper and lower surface of the wings. Given density of air = 1.3 kg/m3, g=10m/s^2.	**5**
32	A bob of mass m is suspended by a light string of length L. It is imparted a horizontal velocity v_o at the lowest point A such that it completes a semi-circular trajectory in the vertical plane with the string becoming slack only on reaching the topmost point, C.This is shown in figure. Obtain an expression for (i)v_o ; (ii) the speeds at points B and C; (iii) the ratio of the kinetic energies (K_B/k_c) at B and C. Comment on the nature of the trajectory of the bob after it reaches the point C. 	**5**
33	a)A driver of a car travelling at 52 Km/h applies the brakes and decelerates uniformly. The car stops in 5 seconds. Another driver going at 34 km/h applies his brakes slower and stops after 10 seconds. On the same graph, plot the speed verses time graph for two cars. Which of the two cars travel farther and by what distance after the brakes were applied? b)A particle performing uniform circular motion has angular momentum L. What will be the new angular momentum, if its angular frequency is doubled and kinetic energy halved.	**5**

Answer Key
Physics XI [Set - B]

1	B	
2	A	
3	C	
4	B	
5	D	
6	C	
7	A	
8	A	
9	C	
10	C	
11	B	
12	A	
13	D	
14	A	
15	A	
16	D	
17.	Derivation only	
18	Derivation only	
19	A thermodynamic process where no temp is exchanged between a system and its surroundings. Condition- The system must be perfectly conducting walls The process must be carried out very slowly	
20	$R = u^2/g$ $100 = u^2/10$ $u^2 = 1000$ $H = u^2/2g$ $H = 50$ m	

21	$\frac{\Delta Q}{\Delta t} = KA\frac{\Delta T}{\Delta x}$ As , $\frac{\Delta Q_1}{\Delta t} = \frac{\Delta Q_2}{\Delta t}$ $K_1 A_1 \frac{(T_1 - T_2)}{l} = \frac{K_2 A_2 (T_1 - T_2)}{l}$ $\therefore \frac{A_1}{A_2} = \frac{K_2}{K_1}$	
22	**(i) It is possible to increase the temperature of a gas without adding heat to it, during adiabatic compression the temperature of a gas increases while no heat is given to it.** **(ii) Yes, the amount of heat absorbed is equal to the work done when an ideal gas undergoes an isothermal process** **(iii) When water flowing in broader pipe enters a narrow pipe the area of cross-section of the water decreases therefore the velocity of water increases.**	
23	**Derivation only**	
24	**Derivation only**	
25	**Derivation only**	
26	L.H.S. = V = $[L^3 T^{-1}]$ R.H.S. = $\frac{\pi}{8}\frac{\rho r^4}{\eta l}$ $= \frac{[M^1 L^{-1} T^{-2}]}{[M^1 L^{-1} T^{-1}]}\frac{[L]^4}{[L]^1}$ $= [M^0 L^3 T^{-1}]$ As LHS = RHS, dimensionally $\therefore$ The relation is correct  	
27	**Derivation only**	
28	**M1C1ΔT + M2C2ΔT = M3C3ΔT** **(200*0.3906 + 150*1.554)(T - 20) = 80*0.882*(300 - T)** **(78.12 + 233.1)(T - 20) = 70.56(300 - T)** **311.22(T - 20) = 70.56(300 - T)** **4.4(T - 20) = 300 - T** **4.4T - 88 = 300 - T** **5.4T = 388** **T = 71.85°C**	
29	**(i) C** **(ii) B** **(iii) A**	

	(iv) C	
30	**i) A** **(ii) C** **(iii) B** **(iv) A**	
31	**(A). Derivations only** **(B). M=2*10^4 kg. A = 400m^2. V = 250 m/s** **P1 - P2 = 1/2 rho(v2^2- v1^2)** **mg/A = ½(1.3)(v2 - v1)(v2 + v1)** **2*10^4*10/400*250*1.3 = v2 - v1** **By solving v2 - v1 = 1.538 m/s** **P1 - P2 = 500**	
32	At A, $E = \frac{1}{2}mv_0^2 \ldots$(i) The necessary centripetal force mv_0^2/L is provided by $(T_A - mg)$. $T_A - mg = \frac{mv_0^2}{L} \ldots$(ii) At the highest point C, the string slackens as the tension in the string (T_c) becomes zero. $\therefore$ At C, $mg = \frac{mv_C^2}{L} \ldots$(iii) and total energy, $E = \frac{1}{2}mv_C^2 + mg(2L) \ldots$(iv) From (iii), $v_C = \sqrt{gL} \ldots$(v) From (iv), $E = \frac{1}{2}m(gL) + 2mgL = \frac{5}{2}mgL$ Using (i), $\frac{1}{2}mv_0^2 = \frac{5}{2}mgL,\ v_0 = \sqrt{5gL} \ldots$(vi) At B, the energy is $E = \frac{1}{2}mv_B^2 + mg(L)$ or $\frac{1}{2}mv_B^2 = E - mg(L) = \frac{5}{2}mgL - mgL$ $= \frac{3}{2}mgL$ $v_B = \sqrt{3gL}$ $\frac{K_B}{K_C} = \frac{\frac{1}{2}mv_B^2}{\frac{1}{2}mv_C^2} = \frac{3gL}{gL} = \frac{3}{1}$ At C, the string becomes slack and the velocity of the bob is horizontal and to the left. Therefore, the bob will continue on its circular path and complete the revolution.	

33	 A = ½ *5/18*52*5 = 36.1m B = ½*5/18*34*10 = 47.6m Car B travels farther than Car A after breaks are applied (B.) L = I(omega) K = I(omega)^2 2k/I = (omega)^2 2k/I(omega) = I(omega) So L = 2k/I L’ = L/4 (by requirement of ques)	