PHYSICS

BOOKS - SARAS PUBLICATION

BEHAVIOUR OF PERFECT GAS AND KINETIC THEORY

Example

1. Two satellites of earth, S_1 and S_2 aremoving inthe same orbit.The mass of S_1 is four times the mass of S_2. Which oneofthe following statements s true?

A. The kinetic energies of the two satellites are equal

B. The time period of S_1 is four times that of S_2.

C. The potential energies of earth satellites in the two cases are equal.

D. S_1 and S_2 are moving with the same speed.

Answer:

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2. An Engine has an efficiency of $1/6$. When the temperature of sink is reduced $62^\circ C$, its efficiency is doubled. Temperature of source, is:

A. $99^\circ C$

B. $124^\circ C$

C. $37^\circ C$

D. $62^\circ C$

Answer:

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3. The total energy of electron in the ground state of hydrogen atom is $(-13.6eV)$. The kinetic energy of an electron in the first excited state is

A. 1.7 ev

B. 3.4eV

C. 6.8eV

D. 13.6eV

Answer:

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4. A particle of mass m, charge Q and kinetic energy T enters a transverse uniform magnetic , field of induction $\vec{B}$. After 3 seconds the kinetic energy of the particle will be:

A. T

B. 4T

C. 3T

D. 2T

Answer:

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5. At $10^\circ C$ the value of the density of a fixed mass of an ideal gas divided by its pressure is x. At $110^\circ C$ this ratio is:

A. x

B. $\frac{383}{283}x$

C. $\frac{10}{110}x$

D. $\frac{283}{383}x$

Answer:

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6. The rate of increase of thermo e.m.f with temperature at the neutral temperature of a thermocouple:

A. Is negative

B. Is positive

C. Is zero

D. Depends upon the choice of the two materials of the thermocouple

Answer:

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7. Out of the following functions representimg motion of a particle which represents SHM?1). $y = \sin \omega t - \cos \omega t, 2\Big). y = \sin^3 \omega t, 3\Big). y = 5\frac{\cos(3\pi)}{4} - 3\omega^2 t, 4\Big). y = 1 +$.

A. Only(1) and(2)

B. Only (1)

C. Only (4) does not represent SHM

D. Only (1) and (3)

Answer:

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8. Fusion reaction takes place at high temp _____.

A. Molecules break up at high temperature

B. Nuclei break up at highn temperature

C. Atoms get ionised at high temperature

D. Kinetic energy is high enough to overcome the coulomb repulsion between nuclei

Answer:

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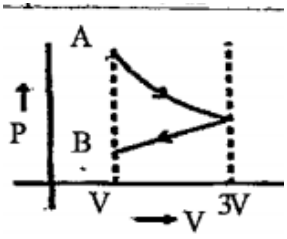
9. One mole of an ideal gas goes from an initial state A to final state B viva two processes: It first undergoes isothermal expansion from Volume

V to3V and then its volume is reduced from 3V to V at constant pressure.

The correct P-V diagram representing the two processes is:

A.



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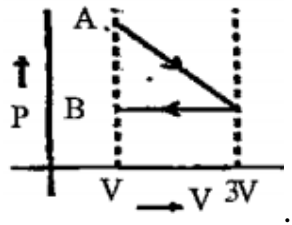

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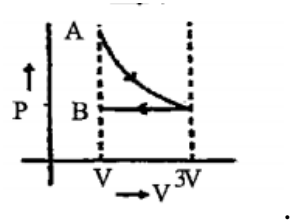
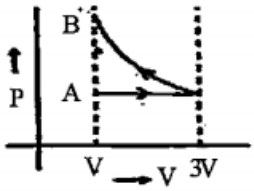


D.



Answer:

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10. The molar specific heats of an ideal gas at a constant pressure & volume are denoted by

$C_P \& C_v$ if $r = \frac{C_p}{C_v}$ & R the universal gases constant then C_v is equal

A. $1 + \frac{\gamma}{1} - \gamma$

B. $\frac{R}{\gamma - 1}$

C. $\frac{\gamma - 1}{R}$

D. γR

Answer:

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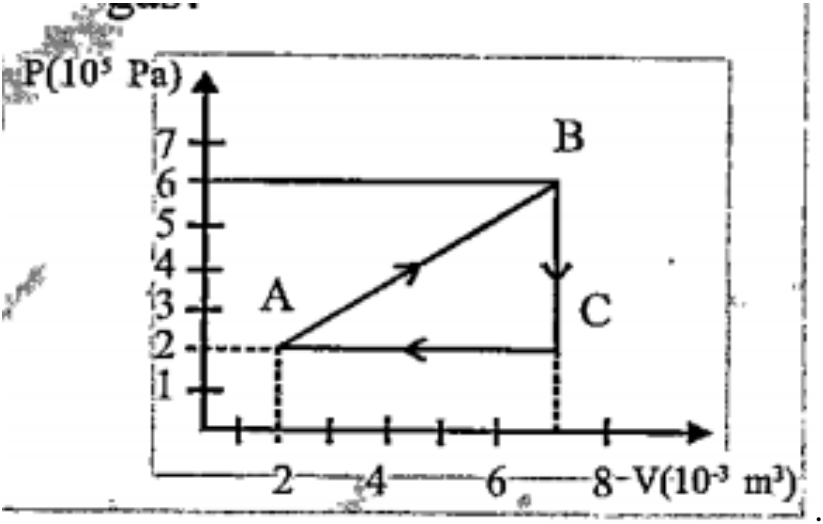
11. A gas is taken through the cycle $A \to B \to C \to A$, as shown. What is the network done by the gas?



A. 2000J

B. 1000J

C. Zero

D. $-2000J$

Answer:

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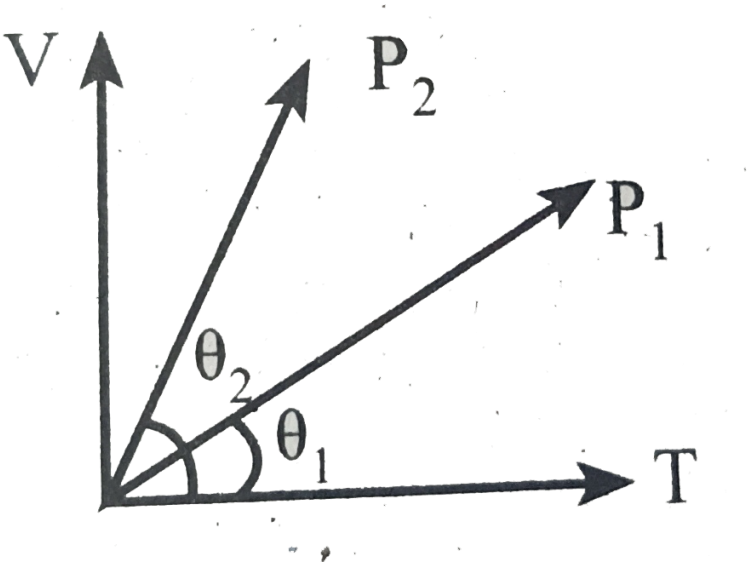
12. In the given (V-T) diagram , what is the relation between $P_1 \text{and} P_2$?



A. $P_2 = P_1$

B. $P_2 > P_1$

C. $P_2 < P_1$

D. Cannot be predicted

Answer:

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13. Two carnot engines A and B are operated in series . The engine A receives heat from the source at temperature T_1 and rejects the heat to the sink at temperature T .The second engine B receives the heat at temperature T and rejects to its sink at temperature T_2 . For what value of T the efficiences of the two engines are equal?

A. $\frac{T_1 + T_2}{2}$

B. $\frac{T_1 - T_2}{2}$

C. $T_1 T_2$

D. $\sqrt{T_1 T_2}$

Answer:

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14. The mean free path of molecules of a gas ,(radius r0 is inverselty propotional to:

A. r^3

B. r^2

C. r

D. $\sqrt{r}$

Answer:

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15. A carnot engine, having efficiency of $\eta = \frac{1}{10}$ as heat engine, is used as a refrigerator. If the work done on the system is 10 J, then find the amount of energy absorbed from the reservoir at lower temperature.

A. 99J

B. 90J

C. 1J

D. 100J

Answer:

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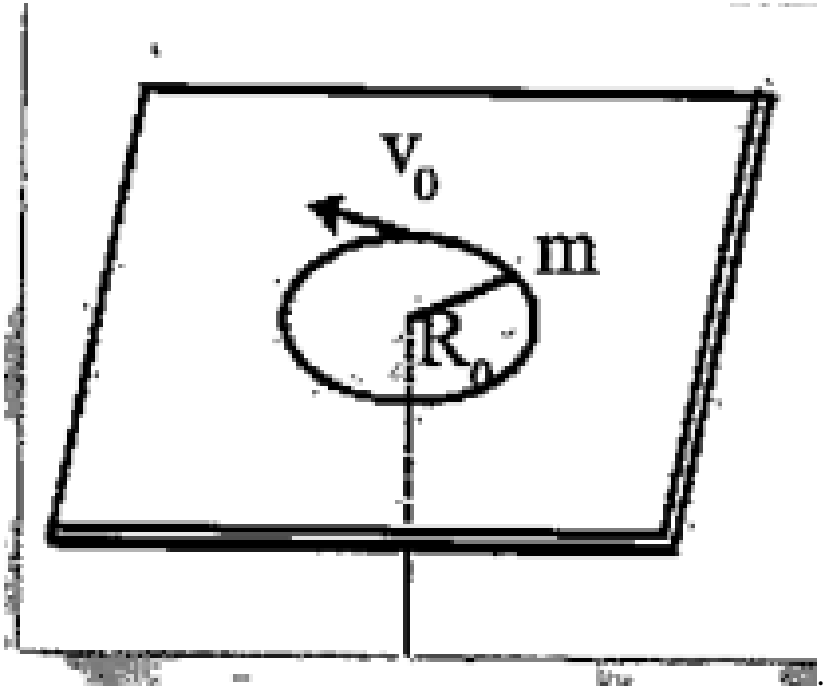
16. A mass m moves in a circle on a smooth horizontal plane with velocity v_0 at radius R_0. The mass is attached to a string which passes through a smooth hole in the plane as shown.The tension in the string is increased gradually and finally m moves in a circle of radius $\frac{R_0}{2}$.The final value of

the kinetic energy is :



A. $\frac{1}{4}mv_0^2$

B. $2mv_0^2$

C. $\frac{1}{2}mv_0^2$

D. mv_0^2

Answer:

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17. A block of mass 10kg moving in x direction with a constant speed of $10ms^{-1}$, is subjected to a retarding force $F = 0.1xJ/m$ during its travel from x=20 m to 30 m . Its final KE will be:

A. 450 J

B. 275J

C. 250J

D. 475J

Answer:

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18. 4.0 g of gas occupies 22.4 litres at NTP . The specific heat capacityof the gas at constant volume is $5.0jk^{-1}mol^{-1}$if the speed of sound in this gas at NTP is $952ms^{-1}$, then the heat capacity at constant pressure is: (Take gas constant $R = 8.3JK^{-1}mol^{-1}$).

A. $8.5JK^{-1}mol^{-1}$

B. $8.0JK^{-1}mol^{-1}$

C. $7.5JK^{-1}mol^{-1}$

D. $7.0JK^{-1}mol^{-1}$

Answer:

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19. A series R-C circuit is connected to an alternating voltage source . Consider two situations: When capacitor is air filled, When capacitor is mica filled. Current through resistor is i and voltage across capacitor is V then:

A. $V_a - V_b$

B. $V_a < V_b$

C. $V_a > V_b$

D. $i_a > i_b$

Answer:

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20. A particle of mass 10g moves along a circle of radius 6.4 cm with a constant tangential acceleration . What is the magnitude of this acceleration if the kinetic energy of the particle becomes equal to $8 \times 10^{-4} J$ by the end of the second revolution after the beginning of the motion?

A. $0.2 m / s^2$

B. $0.1 m / s^2$

C. $0.15 m / s^2$

D. $0.18 m / s^2$

Answer:

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21. The molecules of a given mass of a gas have rms velocity of $200ms^{-1}$ at $27^{\circ}C$ and $1.0 \times 10^{5}Nm^{-2}$ perssure. What the temperature and perssure of the gas are respectively.

$127^{\circ}C$ and $0.05 \times 10^{5}Nm^{-2}$

Find the rms velocity of its molecules in ms^{-1}

A. 100/3

B. $100\sqrt{2}$

C. $\frac{400}{\sqrt{3}}$

D. $\frac{100\sqrt{2}}{3}$

Answer:

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22. A solid sphere of mass m and radius R is rotating about its diameter. A solid cylinder of the same mass and same radius is also rotating about its

geometrical axis with an angular speed twice that of the sphere. The ratio of their kinetic energies of rotation $\left(E_{sphere} / E_{cyl \in der}\right)$ will be :

A. $1:4$

B. $3:1$

C. $2:3$

D. $1:5$

Answer:

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23. A given sample of an ideal gas occupies a volume V at a pressure P and absolute temperature T . The mass of each molecule of the gas is m. Which of the following gives the density of the gas?

A. $P/(kTV)$

B. mkT

C. $P/(kT)$

D. $Pm/(kT)$

Answer:

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24. A gas mixture consists of 2 moles of O_2 and 4 moles of Ar at temperature T. Neglecting all vibrational modes, the total internal energy of the system is :

A. 15RT

B. 9RT

C. 11RT

D. 4RT

Answer:

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