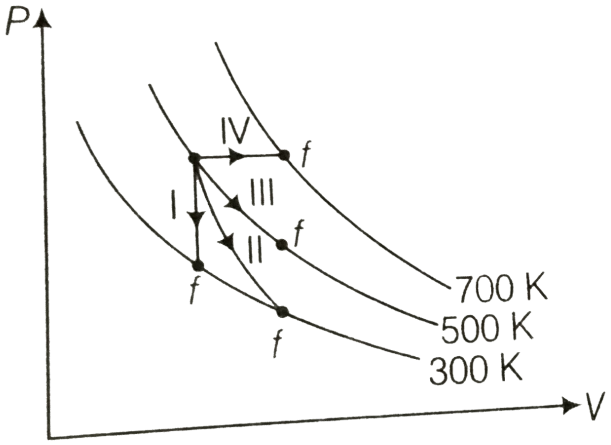
PHYSICS

BOOKS - NEET PREVIOUS YEAR (YEARWISE + CHAPTERWISE)

HEAT AND THERMODYNAMICS

Physics

1. Thermodynamic processes are indicated in the following diagrams



Match the following

	Column - I		Column -II
P	Process I	a	Adiabatic
Q	Process II	b	Isobaric
R	Process III	c	Isochoric
S	Process IV	d	Isothermal

A. P $\rightarrow$ a, Q $\rightarrow$ c, R $\rightarrow$ d, S $\rightarrow$ b

B. P $\rightarrow$ c, Q $\rightarrow$ a, R $\rightarrow$ d, S $\rightarrow$ b

C. P $\rightarrow$ c, Q $\rightarrow$ d, R $\rightarrow$ b, S $\rightarrow$ a

D. $P \rightarrow d, Q \rightarrow b, R \rightarrow a, S \rightarrow c$

Answer: B

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

A. 4RT

B. 15 RT

C. 9RT

D. 11RT

Answer: D

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3. A carnot engine, having an efficiency of $\eta = 1/10$ as heat engine, is used as a refrigerator. If the work done on the system is

$10J$, the amount of energy absorbed from the reservior at lower temperature is

A. 1 J

B. 90 J

C. 99 J

D. 100 J

Answer: B

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4. A black body is at a temperature of $5760K$. The energy of radiation emitted by the body at wavelength $250nm$ is U_1 at wavelength $500nm$ is U_2 and that at $1000nm$ is U_3. Wien's consant, $b = 2.88 \times 10^6 nmK$. Which of the following is correct?

A. $U_3 = 0$

B. $U_1 > U_2$

C. $U_2 > U_1$

D. $U_1 = 0$

Answer: C

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5. A gas is compressed isothermally to half its initial volume. The same gas is compressed separately through an adiabatic process untill its volume is again reduced to half. Then

A. compressing the gas through adiabatic process will require more work to be done.

B. compressing the gas isothermally or adiabatically will require the same amount of work.

C. which of the case (whether compression through isothermal or through adiabatic process) reequires more work will depend upon the atomicity of the gas.

D. compressing the gas isothermally will require more work to be done

Answer: A

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6. A piece of ice falls from a height h so that it melts completely. Only one-quarter of the heat produced is absobed by the ice and all energy of ice gets converted into heat during its fall. The value of h is

[Latent heat of ice is $3.4 \times 10^5 J/kg$ and $g = 10N/kg$]

A. 544 km

B. 136 km

C. 68 km

D. 34 km

Answer: B

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7. A refrigerator works between $4^{\circ}C$ and $30^{\circ}C$. It is required to remove $600cal$ or ies of heat every second in order to keep the temperature of the refrigerator space

constant.The power required is (Take $1cal \text{ or } ie = 4.2J$)

A. 23.65 W

B. 236.5 W

C. 2365 W

D. 2.365 W

Answer: B

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8. Two identical bodies are made of a material for which the heat capacity increases with temperature. One of these is at $100^\circ C$. While the other one is at $0^\circ C$. If the two bodies are brought into contact, then assuming no heat loss, the final common temperature is

A. $50^\circ C$

B. more than $50^\circ C$

C. less than $50^\circ C$ but greater than $0^\circ C$

D. $0^\circ C$

Answer: B

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9. A body cools from a temperature $3T$ to $2T$ in 10 minutes. The room temperature is T. Assume that Newton's law of cooling is applicable. The temperature of the body at the end of next 10 minutes will be

A. $\frac{7}{4}T$

B. $\frac{3}{2}T$

C. $\frac{4}{3}T$

D. T

Answer: B

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10. One mole of an ideal monatomic gas undergoes a process described by the equation PV^3= constant. The heat capacity of the gas during this process is

A. $\frac{3}{2}R$

B. $\frac{5}{2}R$

C. $2R$

D. R

Answer: D

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11. The temperature inside a refrigerator is $t_2^\circ C$. The amount of heat delivered to the

room for each joule of electrical energy consumed ideally will be

A. $\frac{t_1}{t_1 - t_2}$

B. $\frac{t_1 + 273}{t_1 - t_2}$

C. $\frac{t_2 + 273}{t_1 - t_2}$

D. $\frac{t_1 + t_2}{t_1 + 273}$

Answer: B

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12. A fiven sample of an ideal gas occupise a volume V at a pressure p and sbsoulte temperature T.The mass of each molecule of the gas is m. Which of the following fives the dinsity of the gas ?

A. $p/(kT)$

B. $pm/(kT)$

C. $p/(kTV)$

D. mkT

Answer: B

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13. On observing light from three different stars P, Q and R, it was found that intensity of violet colour is maximum in the spectrum of P, the intensity of green colour is maximum in the spectrum of R and the intensity of red colour is maximum in the spectrum of Q. if T_P, T_Q and T_R are respective absolute temperature of P, Q and R. then it can be concluded from the above observation that

A. $T_p > T_Q > T_R$

B. $T_P > T_R > T_Q$

C. $T_P < T_R < T_Q$

D. $T_P < T_Q < T_R$

Answer: B

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14. The two ends of a metal rod are maintained at temperature $100^\circ C$ and $110^\circ C$. The rate of heat flow in the rod is found to be

$4.0J/s$. If the ends are maintained at temperature s $200^\circ C$ and $210^\circ C$. The rate of heat flow will be

A. $44.0J/s$

B. $16.8J/s$

C. $8.0J/s$

D. $4.0J/s$

Answer: D

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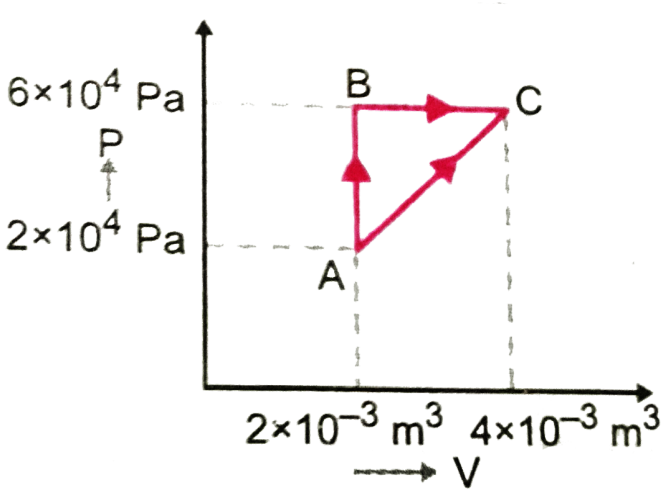
15. In (figure). shows two path that may be taken by a gas to go from a state A to state C



In the process AB, $400J$ of heat is added to the system and in process Bc, $100J$ of heat is added to the system. The heat absorbed by the system in the process AC will be

A. 380 J

B. 500 J

C. 460 J

D. 300 J

Answer: C

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16. A carnot engine, having an efficiency of $\eta = 1/10$ as heat engine, is used as a refrigerator. If the work done on the system is

$10J$, the amount of energy absorbed from the reservior at lower temperature is

A. 100J

B. 99 J

C. 90 J

D. 1 J

Answer: C

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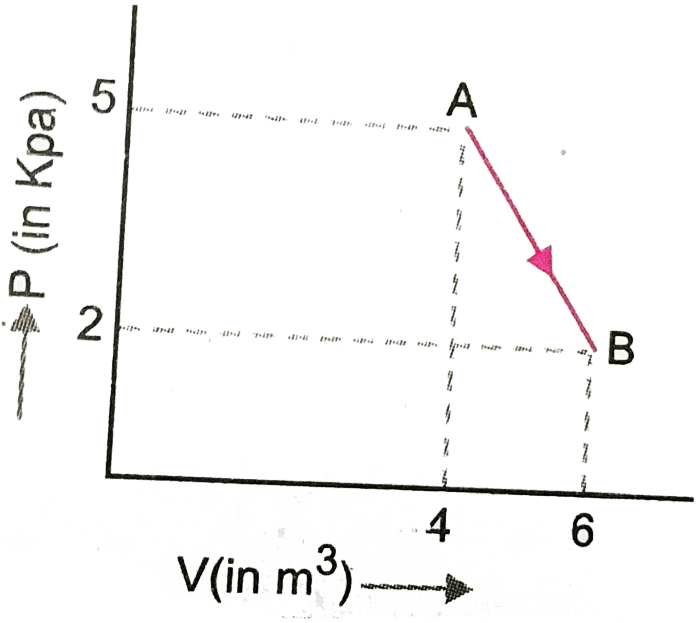
17. One mole of an ideal diatomic gas undergoes a transition from A to B along a path AB as shown in (figure). The change in internal energy of the gas during the transition is $(\gamma = 3/5)$



A. $20kJ$

B. $-20kJ$

C. $20J$

D. $-12J$

Answer: B

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18. The ratio of the specific heats $\frac{C_P}{C_v} = \gamma$ in terms of degrees of freedom is given by

A. $\left(1+\frac{1}{n}\right)$

B. $\left(1+\frac{n}{3}\right)$

C. $\left(1+\frac{2}{n}\right)$

D. $\left(1+\frac{n}{2}\right)$

Answer: C

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19. An ideal gas is compressed to half its initial volume by means of several peocesses. Which

of the process results in the maximum work done on the gas ?

A. Adiabatic

B. Isobaric

C. Isochoric

D. Isothermal

Answer: A

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20. $4.0g$ of a gas occupies 22.4 litres at NTP. The specific heat capacity of 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

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

B. $7.5KJ^{-1}mol^{-1}$

C. $7.0KJ^{-1}mol^{-1}$

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

Answer: A

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21. The cofficient of performance of a refrigerator is 5. If the temperature inside freezer is $-20^{\circ}C$, the temperature of the surroundings to which it rejects heat is :

A. $31^{\circ}C$

B. $41^{\circ}C$

C. $11^{\circ}C$

D. $21^{\circ}C$

Answer: A

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22. Two vessel separately contains two ideal gases A and B at the same temperature, the pressure of A being twice that of B. under such conditions, the density of A is found to be 1.5 times the density of B. the ratio of molecular weight of A and B is

A. $\frac{2}{3}$

B. $\frac{3}{4}$

C. 2

D. $\frac{1}{2}$

Answer: B

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23. The value of coefficient of volume expansion of glycerin is $5 \times 10^{-4} K^{-1}$. The fractional change in the density of glycerin for a rise of $40^{\circ} C$ in its temperature is

A. 0.015

B. 0.02

C. 0.025

D. 0.01

Answer: B

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24. Steam at $100^\circ C$ is passed into $20g$ of water at $10^\circ C$ when water acquire a temperature of $80^\circ C$, the mass of water

present will be

[Take specific heat of water $= 1 cal g^{-1}.^{\circ} C^{-1}$ and latent heat of steam $= 540 cal g^{-1}$]

A. 24 g

B. 31.5 g

C. 42.5 g

D. 22.5g

Answer: D

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25. Certain quantity of water cools from $70^\circ C$ to $60^\circ C$ in the first 5 minutes and to $54^\circ C$ in the next 5 minutes. The temperature of the surrounding is

A. $45^\circ C$

B. $20^\circ C$

C. $42^\circ C$

D. $10^\circ C$

Answer: A

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26. A monoatomic gas at a pressure p, having a volume 2V and then adiabatically to a volume 16 V. The final pressure of the gas is (take $\gamma = \frac{5}{3}$)

A. 64p

B. 32 p

C. $\frac{p}{32}$

D. 16 p

Answer: C

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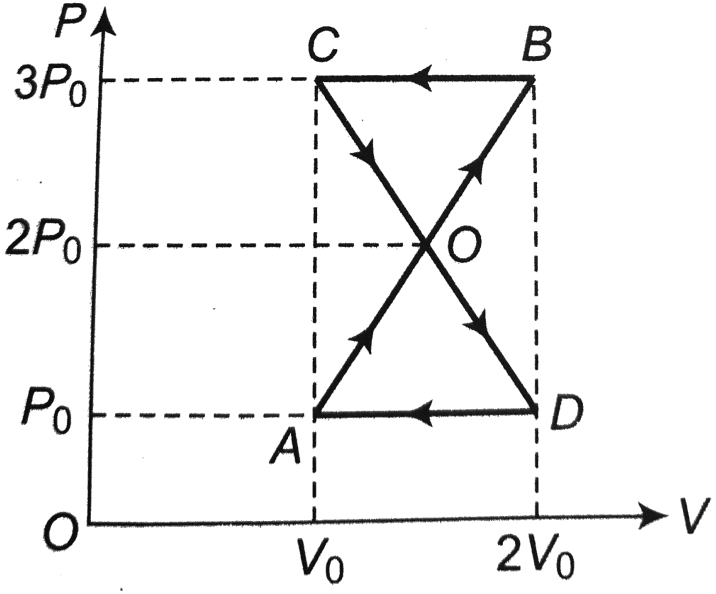
27. A thermodynamic system undergoes cyclic process $ABCDA$ as shown in figure. The work

done by the system is



A. $p_0 v_0$

B. $2p_0 v_0$

C. $\frac{p_0 v_0}{2}$

D. zero

Answer: d

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28. The mean free path of molecules of a gas (radius r) is inversely proportional to

A. r^3

B. r^2

C. r

D. $\sqrt{r}$

Answer: d

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29. The molar specific heats of an ideal gas at constant pressure and volume are denotes by C_P and C_v respectively. If $\gamma = \frac{C_P}{C_v}$ and R is the universal gas constant, then C_v is equal to

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

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

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

D. γR

Answer: c

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30. A piece of iron is heated in a flame. It first becomes dull red then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using.

A. Stefan's law

B. Wien's displacement law

C. Kirchhoff's law

D. Newton's law of cooling

Answer: c

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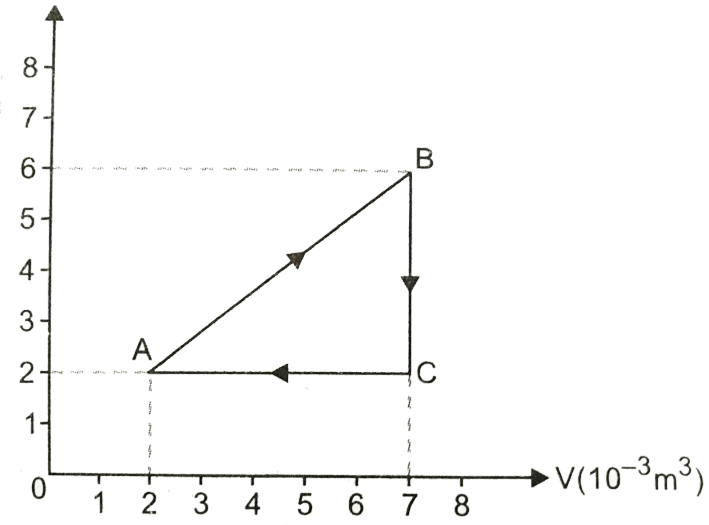
31. A gas is taken through the cycle $A \rightarrow B \rightarrow C \rightarrow A$, as shown in figure, what

is the net work done by the gas?



A. 2000 J

B. 1000 J

C. Zero

D. $-2000J$

Answer: b

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32. During an adiabatic process, the pressure of gas is found to be proportional to the cube of its absolute temperature. The ratio of $(C_{p,m}/C_{v,m})$ for gas is :

A. $\frac{4}{3}$

B. 2

C. $\frac{5}{3}$

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

Answer: d

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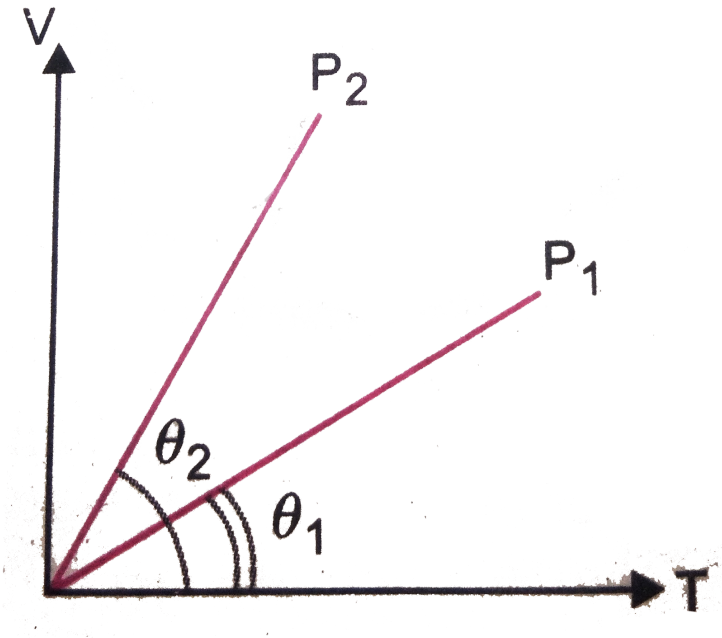
33. In the given (V-T) diagram, what is the relation between pressure P_1 and P_2 ?



A. $p_2 = p_1$

B. $p_2 > p_1$

C. $p_2 < p_1$

D. Cannot be predicated

Answer: c

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34. The amount of heat energy required to raise the temperature of 1 g of Helium at NTP, from T_1 K to T_2 K is :

A. $\frac{3}{8}N_aK_B(T_2 - T_1)$

B. $\frac{3}{2}N_aK_B(T_2 - T_1)$

C. $\frac{3}{4}N_aK_B(T_2 - T_1)$

D. $\frac{3}{4}N_aK_B\left(\frac{T_2}{T_1}\right)$

Answer: a

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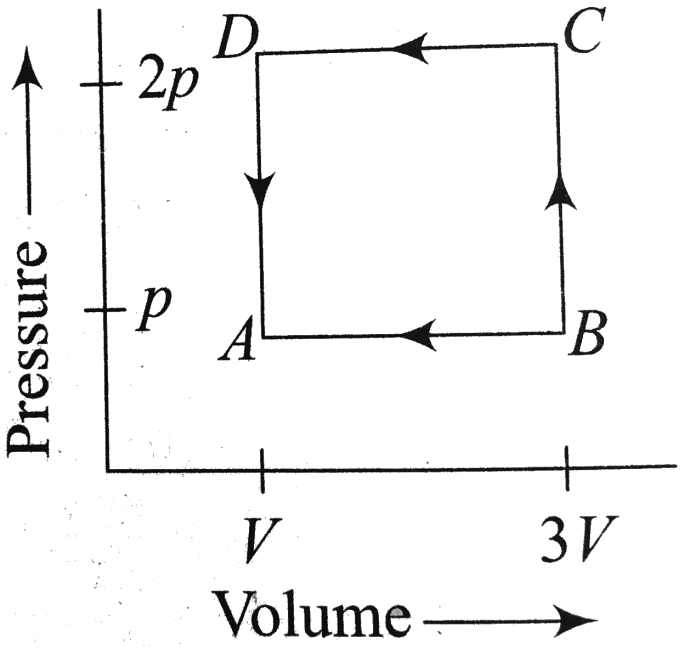
35. A thermodynamic system is taken through the cycle $ABCD$ as shown in the figure. Heat

rejected by the gas during the cycle is



A. 2 pV

B. 4 pV

C. $\frac{1}{2}pV$

D. pV

Answer: a

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36. If the radius of a star is R and it acts as a black body, what would b the temperature of the star, in which the rate of energy production is Q?

A. $Q/4\pi R^2\sigma$

B. $\left(Q/4\pi R^2\sigma\right)^{-1/2}$

C. $\left(4\pi R^2 Q/\sigma\right)^{1/4}$

D. $\left(Q/4\pi R^2\sigma\right)^{1/4}$

Answer: d

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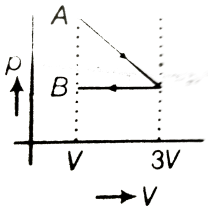
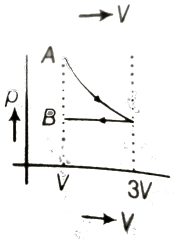
37. One mole of an ideal gas goes from an initial state A to final state B via two processs : It first undergoes isothermal expansion from volume V to $3V$ and then its volume is reduced from $3V$ to V at constant pressure.

The correct $P - V$ diagram representing the two process in (figure)

A. 

B. 

C. 

D. 

Answer: d

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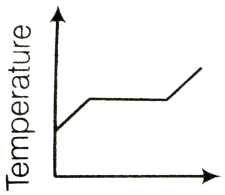
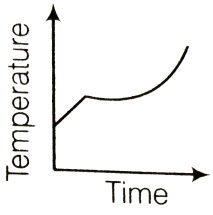
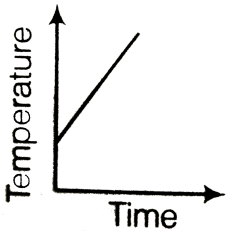
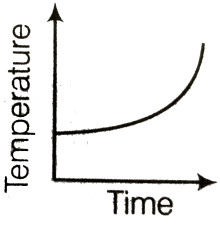
38. Liquid oxygen at $50K$ is heated to $300K$ at constant pressure of $1atm$. The rate of heating is constant. Which of the following graphs represents the variation of temperature with time?

A. 

B. 

C. 

D. 

Answer: a

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39. When $1kg$ of ice at $0^\circ C$ melts to water at $0^\circ C$, the resulting change in its entropy, taking latent heat of ice to be $80cal/g$ is

A. 8×10^4 cal/K

B. 80 cal/K

C. 293 cal/K

D. 273 cal/K

Answer: c

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40. During an isothermal expansion, a confined ideal gas does $-150J$ of work aginst its surroundings. This implies that

A. 300 J of heat has been added to the gas

B. no heat is transferred because the process is isothermal

C. 150 J of heat has been added to the gas

D. 150 J of heat has been removed from the gas

Answer: c

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41. If ΔU and ΔW represent the increase in internal energy and work done by the system resectively in a thermodynamical process, which of the following is true?

A. $\Delta U = -\Delta W$, in an adiabatic process

B. $\Delta U = \Delta W$, in an isothermal process

C. $\Delta U = \Delta W$, in an adiabatic process

D. $\Delta U = -\Delta W$, in an isothermal process

Answer: a

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42. A cylindrical metallic rod in thermal contact with two reservation of heat at its two ends conducts an amount of heat Q in time t. The metallic rod is melted and the material is formed into a rod of half the radius of the original rod. What is the amount of heat conducted by the new rod when placed in thermal contact with the two reservation in time t?

A. $Q/4$

B. $Q/16$

C. 2Q

D. $Q/2$

Answer: b

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43. A black body at $227^\circ C$ radiates heat at the rate of $7calcm^{-2}s^{-1}$. At a temperature of $727^\circ C$, the rate of heat radiated in the same unit will be

A. 60

B. 50

C. 112

D. 80

Answer: c

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44. In thermodynamic processes which of the following statement is not true?

A. In an adiabatic process the system is insulated from the surrounding

B. In an isochoric process remains constant

C. In an isothermal process the temperature remains constant

D. In an adiabatic process pV^{γ} = constant

Answer: b

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45. The two ends of a rod of length L and a uniform cross-sectional area A are kept at two temperature T_1 and T_2 $(T_1 > T_2)$. The rate of heat transfer. $\frac{dQ}{dt}$, through the rod in a steady state is given by

A. $\frac{dQ}{dt} = \frac{KL(T_1 - T_2)}{A}$

B. $\frac{dQ}{dt} = \frac{L(T_1 - T_2)}{LA}$

C. $\frac{dQ}{dt} = KLA(T_1 - T_2)$

D. $\frac{dQ}{dt} = \frac{KA(T_1 - T_2)}{L}$

Answer: d

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46. The internal energy change in a system that has absorbed $2kcal$ of heat and done $500J$ of work is

A. 8900 J

B. 6400 J

C. 5400 J

D. 7900 J

Answer: d

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47. 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: d

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48. If Q, E and W denote respectively the heat added, change in internal energy and the work done in a closed cycle process, then

A. $W = 0$

B. $Q = W = 0$

C. $E = 0$

D. $Q = 0$

Answer: c

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49. On a new scale of temperature (which is linear) and called the W scale. The freezing and boiling points of water are $39^\circ W$ and $239^\circ W$ respectively. What will be the temperature on the new scale, corresponding to a temperature of $39^\circ C$ on the Celsius scale?

A. $78^\circ W$

B. $117^\circ W$

C. $200^\circ W$

D. $139^\circ W$

Answer: b

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50. An engine has an efficiency of $\frac{1}{6}$. When the temperature of sink is reduced by $62^\circ C$, its efficiency is doubled. Temperature of the source is

A. $124^\circ C$

B. $37^\circ C$

C. $62^\circ C$

D. $99^\circ C$

Answer: d

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51. A black body is at $727^\circ C$. It emits energy at a rate which is proportional to

A. $(727)^2$

B. $(1000)^4$

C. $(1000)^2$

D. $(727)^4$

Answer: b

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52. Assuming the sun to have a spherical outer surface of radius r radiating like a black body at temperature $t^\circ C$. The power received by a

unit surface (normal to the incident rays) at a distance R from the centre of the sun is where σ is the Stefan's constant.

A. $\frac{4\pi r^2 t^4}{R^2}$

B. $\frac{r^2\sigma(t+273)^4}{4\pi R^2}$

C. $\frac{16\pi^2 r^2 \sigma t^4}{R^2}$

D. $\frac{r^2\sigma(t+273)^4}{R^2}$

Answer: d

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53. The molar specific heat at constant pressure of an ideal gas is $(7/2R)$. The ratio of specific heat at constant pressure to that at constant volume is

A. $7/5$

B. $8/7$

C. $5/7$

D. $9/7$

Answer: a

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54. A black body at $1227^{\circ}C$ emits radiations with maximum intensity at a wavelength of 5000Å. If the temperature of the body is increased by 1000°, the maximum intensity will be observed at

A. 4000Å

B. 5000Å

C. 6000Å

D. 3000Å

Answer: d

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55. A Carnot engine whose sinl is at $300K$ has an efficiency of 40%. By how much should the temperature of source be increased so as to increase its efficiency by 50% of original efficiency.

A. 275 K

B. 325 K

C. 250 K

D. 380 K

Answer: c

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56. An ideal gas heat engine operates in Carnot cycle between $227^\circ C$ and $127^\circ C$. It absorbs $6.0 \times 10^4 cal$ of heat at high temperature. Amount of heat converted to work is :

A. 2.4×10^4 cal

B. 6×10^4 cal

C. 1.2×10^4 cal

D. 4.8×10^4 cal

Answer: c

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57. Which of the following processes is reversible?

A. Transfer of heat by radiation

B. Electrical heating of a nichrome wire

C. Transfer of heat by conduction

D. Isothermal compression

Answer: d

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58. Which of the following circular rods (given radius r and length l) each made of the same

material and whose ends are maintained at the same temperature will conduct most heat?

A. $r = 2r_0, l = 2l_0$

B. $r = 2r_0, l = l_0$

C. $r = r_0, l = l_0$

D. $r = r_0, l = 2l_0$

Answer: b

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59. The equation of state for 5 g of oxygen at a pressure P and temperature T, when occupying a volume V, will be

A. $pV = \left(\frac{5}{32}\right)RT$

B. $pV = 5RT$

C. $pV = \left(\frac{5}{32}\right)RT$

D. $pV = \left(\frac{5}{16}\right)RT$

Answer: a

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60. One mole of an ideal gas at an initial temperature true of TK does $6R$ joule of work adiabatically. If the ratio of specific heats of this gas at constant pressure and at constant volume is $5/3$, the final temperature of the gas will be

A. $(T + 2.4)K$

B. $(T - 2.4)K$

C. $(T + 4)K$

D. $(T - 4)K$

Answer: d

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61. If λ_m denotes the wavelength at which the radiative emission from a black body at a temperature TK is maximum, then

A. $lambd_m \propto T^4$

B. λ_m is independent of T

C. $\lambda_m \propto T$

D. $\lambda_m \propto T^{-1}$

Answer: d

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62. We consider the radition emitted by the human body which of the following statements is true?

A. The radiation is emitted during the summers and absorbed during the winters

B. The radiation emitted lies in the ultraviolet region and hence is not visible

C. The radiation emitted is in the infrared ragion

D. The ratiation is emitted only during the day

Answer: c

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63. An ideal gas heat engine operates in a Carnot cycle between $227^{\circ}C$ and $127^{\circ}C$. It absorbs $6Kcal.$ of heat at higher temperature. The amount of heat in $kcal$ rejected to sink is

A. 1.6

B. 1.2

C. 4.8

D. 3.5

Answer: b

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64. Consider a compound slab consisting of two different material having equal thickness and thermal conductivities K and $2K$ respectively. The equivalent thermal conductivity of the slab is

A. $3K$

B. $\frac{4}{3}K$

C. $\frac{2}{3}K$

D. $\sqrt{2}K$

Answer: b

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65. For a black body at temperature $727^\circ C$, its radiating power is 60 watt and temperature of surrounding is $227^\circ C$. If temperature of black body is changed to $1227^\circ C$ then its radiating power will be-

A. 120 W

B. 240 W

C. 304 W

D. 320W

Answer: d

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66. The efficiency of carnot engine is 50% and temperature of sink is 500K. If temperature of source is kept constant and its efficiency

raised to 60%, then the required temperature of the sink will be : -

A. $600K$

B. $500K$

C. $400K$

D. $100K$

Answer: c

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67. Condider two rods of same length and different specific heats (s_1, s_2), thermal conductivities (K_1, K_2) and areas of cross-section (A_1, A_2) and both having temperatures (T_1, T_2) at their ends. If their rate of loss of heat due to conduction are equal, then

A. $K_1 A_1 = K_2 A_2$

B. $\frac{K_1 A_1}{s_1} = \frac{K_2 A_2}{s_2}$

C. $K_2 A_1 = K_1 A_2$

D. $\frac{K_2 A_1}{s_2} = \frac{K_1 A_2}{s_1}$

Answer: a

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68. The unit of Stefan's constant σ is

A. $W - m^2 - K^4$

B. $W - m^2 / K^4$

C. $W / m^2 - K$

D. $W / m^2 - K^4$

Answer: d

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69. Wien's law is concerned with

A. wavelength corresponding to maximum energy and absolute temperature

B. radiated energy and wavelength

C. emissive power and temperature

D. colour of light and temperature

Answer: a

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70. Which of the following is close to an ideal black body ?

A. Black lamp

B. Cavity maintained at constant temprature

C. Platinum black

D. A lamp of charcoal heated to high temperature

Answer: b

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71. Rate of heat flow through a cylindrical rod is H_1. Temperatures of ends of rod are T_1 and T_2. If all the dimensions of rod become double and temperature difference remains same and

rate of heat flow becomes H_2. Then $\frac{H_1}{H_2}$ is $0.\ x$. Find value of x.

A. $H_2 = 2H_1$

B. $H_2 = \frac{H_1}{2}$

C. $H_2 = \frac{H_1}{4}$

D. $H_2 = 4H_1$

Answer: a

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72. A scientist says that the efficiency of his heat engine which operates at source temperature $127^\circ C$ and sink temperature $27^\circ Cis26\ \%$, then

A. it is impossible

B. it is possible with high probability

C. it is possible with low probability

D. Date is insufficient

Answer: a

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73. A black body has maximum wavelength λ_m at temperature $2000K$. Its corresponding wavelength at temperature 3000 will be

A. $\frac{2}{3}\lambda$

B. $\frac{16}{81}\lambda$

C. $\frac{81}{16}\lambda$

D. $\frac{4}{3}\lambda$

Answer: a

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74. Which one of the following processes depends on gravity ?

A. Conduction

B. Convection

C. Radiation

D. None of these

Answer: b

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75. The gases carbon-monoxide (CO) and nitrogen at the same temperature have kinetic energies E_1 and E_2 respectively. Then

A. $E_1 = E_2$

B. $E_1 > E_2$

C. $E_1 < E_2$

D. E_1 and E_2 cannot be compared

Answer: a

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76. An engine takes heat from a reservior and converts its $1/6$ part into work. By decreasing temperature of sink by $62^{\circ}C$, its efficiency becomes double. The temperatures of source and sink must be

A. $90^{\circ}C, 37^{\circ}C$

B. $99^{\circ}C, 37^{\circ}C$

C. $372^{\circ}C, 37^{\circ}C$

D. $206^{\circ}, 37^{\circ}C$

Answer: b

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77. The degrees of freedom of a molecule of a triatomic gas are

A. 2

B. 4

C. 6

D. 8

Answer: c

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78. An ideal gas at $27^\circ C$ is compressed adiabatically to $8/27$ of its original volume. If $\gamma = 5/3$, then the rise in temperature is

A. $475^\circ C$

B. $402^\circ C$

C. $275^\circ C$

D. $375^\circ C$

Answer: d

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79. Coefficient of linear expansion of brass and steel rods are α_1 and α_2. Length of brass and steel rods are l_1 and l_2 respectively. If $(l_2 - l_1)$ is maintained same at all temperature, which one of the following relations holds good?

A. $\alpha_1 l_1 = \alpha_2 l_2$

B. $\alpha_1 l_2 = \alpha_2 l_1$

C. $\alpha_1^2 l_2 = \alpha_2^2 l_1$

D. $\alpha_1 l_2^2 = \alpha_2 l_1^2$

Answer: a

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80. if 1 g of system is mixed with 1 g of ice, then the resultant temperature of the mixture is

A. $270^\circ C$

B. $230^\circ C$

C. $100^\circ C$

D. $50^\circ C$

Answer: c

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81. The radiant energy from the Sun incident normally at the surface of earth is $20kcal/m^2$ min What would have been the radiant energy

incident normally on the earth if the sun had a temperature twice of the present one ? .

A. $160 kcal / m^2$ min

B. $40 kcal / m^2$ min

C. $320 kcal / m^2$ min

D. $80 kcal / m^2$ min

Answer: c

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82. We consider a thermodynamic system. If ΔU represents the increase in its internal energy and W the work done by the system, which of the following statements is true?

A. $\Delta U = -W$ in an adiabatic process

B. $\Delta U = W$ in an isothermal process

C. $\Delta U = -W$ in an isothernal process

D. $\Delta U = W$ in an adiabatic process

Answer: a

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83. If the ratio of specific heat of a gas of constant pressure to that at constant volume is γ, the change in internal energy of the mass of gas, when the volume changes from V to $2V$ at constant pressure p is

A. $\frac{R}{(\gamma - 1)}$

B. pV

C. $\frac{pV}{(\gamma - 1)}$

D. $\frac{\gamma pV}{(\gamma - 1)}$

Answer: c

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84. The efficiency of a Carnot engine operating between temperatures of $100^\circ C$ and $-23^\circ C$ will be

A. $\frac{100-23}{273}$

B. $\frac{100+23}{373}$

C. $\frac{100+23}{100}$

D. $\frac{100-23}{100}$

Answer: b

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85. A black body is at temperature of $500K$. It emits energy at rate which is proportional to

A. $(500)^4$

B. $(500)^3$

C. $(500)^2$

D. 500

Answer: a

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86. A sample of gas expands from volume V_1 to V_2. The amount of work done by the gas is greatest when the expansion is

A. adiabatic

B. isobaric

C. isothermal

D. Equal in all above cases

Answer: b

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87. An ideal gas undergoing adiabatic change has the following pressure-temperature relationship

A. $p^{\gamma-1}T^{\gamma} = \text{constant}$

B. $p^{\gamma}T^{\gamma-1} = \text{constant}$

C. $p^{\gamma}T^{1-\gamma} = \text{constant}$

D. $p^{1-\gamma}T^{\gamma} = \text{constant}$

Answer: d

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88. A diatomic gas initially at 18° is compressed adiabatically to one- eighth of its original volume. The temperature after compression will b

A. $18^\circ C$

B. $668.4K$

C. $395.4^\circ C$

D. $144^\circ C$

Answer: b

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89. A vessel full of hot water is kept in a room and it cools from $80^\circ C$ to $75^\circ C$ in T_1 minutes, from $75^\circ C$ to $70^\circ C$ in T_2 minutes and from $70^\circ C$ to $65^\circ C$ in T_3 minutes Then .

A. $t_1 = t_2 = t_3$

B. $t_1 < t_2 = t_3$

C. $t_1 < t_2 < t_3$

D. $t_1 > t_2 > t_3$

Answer: c

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90. An ideal Carnot's engine whose efficiency 40% receives heat of 500K. If the efficiency is to be 50% then the temperature of sink will be

A. 600 K

B. 700 K

C. 800 K

D. 900 K

Answer: a

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91. If c_0 and c denote the sound velocity and the rms velocity of the molecules in a gas, then

A. $c_s < c$

B. $c_s = c$

C. $c_s = c\left(\frac{\gamma}{3}\right)^{1/2}$

D. None of these

Answer: c

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92. State the equation corresponding to $8g$ of O_2 is

A. $pV = 8RT$

B. $pV = \frac{RT}{4}$

C. $pV = RT$

D. $pV = \frac{RT}{2}$

Answer: b

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93. A body cools from $50^\circ C$ to $49^\circ C$ in 5 s. How long will it take to cool from $40^\circ C$ to $39.5^\circ C$? Assume the temperature of

surroundings to be $30^{\circ} C$ and Newton's law of cooling to be valid:

A. 2.5 s

B. 10 s

C. 20 s

D. 5 s

Answer: b

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94. The temperature of an ideal gas is increased from $27^\circ C$ to $927^\circ C$. The rms speed of its molecules becomes.

A. is $\sqrt{\left(\frac{927}{27}\right)}$ times the earlier value

B. remains the same

C. gets halved

D. gets doubled

Answer: d

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95. If the temperature of the sun (black body) is doubled, the rate of energy received on earth will be increase by a factor of

A. 2

B. 4

C. 8

D. 16

Answer: d

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96. 110 J of heat is added to a gaseous system, whose internal energy change is 40 j. then the amount of external work done is

A. 150 J

B. 70 J

C. 110 J

D. 40 J

Answer: b

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97. An ideal gas A and a real gas B have their volumes increases from $V \rightarrow 2V$ under isothermal condtitions. The increase in internal energy

A. will be same in both A and B

B. will be zero in both the gases

C. of B will be more than that of A

D. of A will be more than that of B

Answer: b

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98. The number of translational degree of freedom for a diatomic gas is

A. 2

B. 3

C. 5

D. 6

Answer: b

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99. Which of the following is not thermodynamical function

A. Enthalpy

B. Work done

C. Gibb's energy

D. Internal energy

Answer: b

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100. Mercury thermometers can be used to measure temperatures upto

A. $260^\circ C$

B. $100^\circ C$

C. $360^\circ C$

D. $500^\circ C$

Answer: c

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101. If for a gas, $\frac{R}{C_V} = 0.67$, the gas is

A. diatomic

B. mixture of diatomic and polyatomic molecules

C. monoatomic

D. polyatomic

Answer: c

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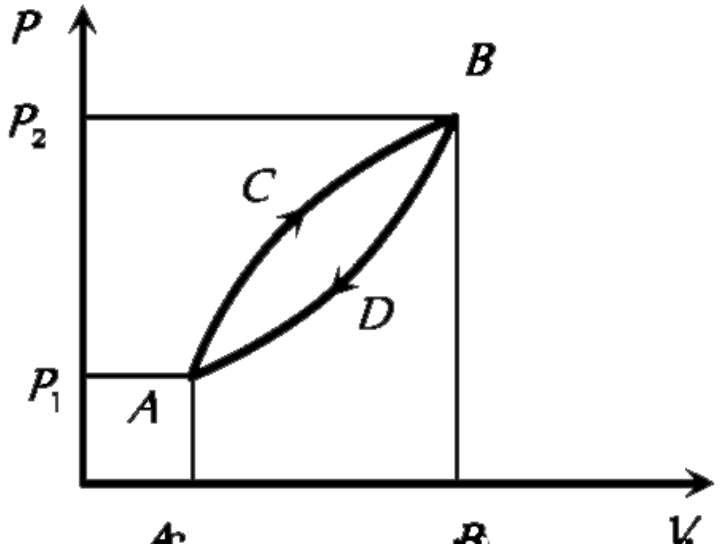
102. A thermodynamic system is taken from state A to B along ACB and is brought back to A along BDA as shown in the PV diagram. The net work done during the complete cycle is given by the area



A. $p_1ACBP_2p_1$

B. A C B B' A' A'

C. A C B D A

D. A D B B' A' A

Answer: c

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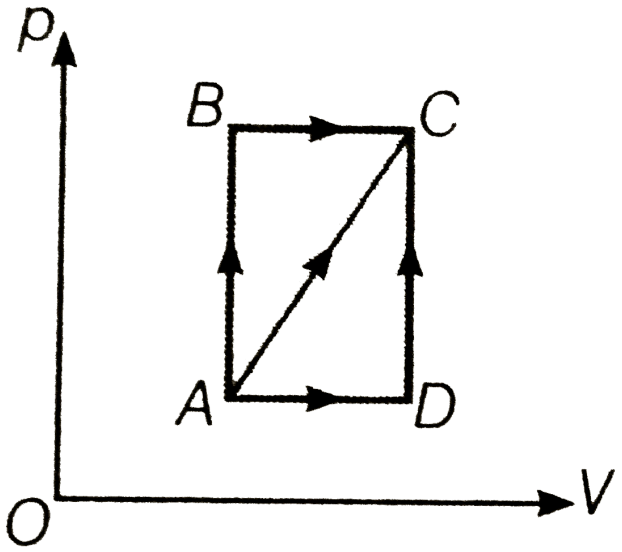
103. A thermodynamic process is shown in the figure. The pressure and volumes corresponding to some points in the figure

are



A. $p_A = 3 \times 10^4$ pa,

B. $V_A = 2 \times 10^{-3} m^3$

C. $P_B = 8 \times 10^4 pa,$

D. $V_B = 5 \times 10^{-3} m^3$

Answer: a

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104. Relation between pressure (p) and energy (E) of a gas is

A. $p = \frac{2}{3}E$

B. $p = \frac{1}{3}E$

C. $p = \frac{3}{2}E$

D. $p = 3E$

Answer: a

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105. Three containes of the same volume contain three different gases. The masses of the molecules are m_1, m_2 and m_3 and the number of molecules in their respective containers are N_1, N_2 and N_3. The gas pressure in the containers are P_1, P_2 and P_3 respectively. All the gases are now mixed and

put in one of the containers. The pressure P of mixture will be

A. $p < (p_1 + p_2 + p_3)$

B. $p = \frac{p_1 + p_2 + p_3}{3}$

C. $p = p_1 + p_2 + p_3$

D. $p > (p_1 + p_2 + p_3)$

Answer: c

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106. For hydrogen gas $C_P - C_V = \alpha$ and for Oxygen gas $C_P - C_V = b$, where C_P and C_V are molar specific heats. Then the relation between 'a' and 'b' is

A. $a = 16b$

B. $16b = a$

C. $a = 4b$

D. $a = b$

Answer: d

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107. One mole of an ideal monoatomic gas requires 207 J heat to raise the temperature by 10 K when heated at constant pressure. If the same gas is heated at constant volume to raise the temperature by the same 10 K, the heat required is [Given the gas constant R = 8.3 J/ mol. K]

A. 198.7 J

B. 29 J

C. 215.3 J

D. 124 J

Answer: d

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108. According to the kinetic theory of gases, at absolute temperature

A. water freezes

B. liquid helium freezes

C. molecular motion stops

D. liquid hydrogen freezes

Answer: c

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109. The thermal capacity of 40 g of aluminium (specific heat $= 0.2 cal / gm^{\circ} C$)

A. $168 J /.^{\circ} C$

B. $672 J /.^{\circ} C$

C. $840 J /.^{\circ} C$

D. $33.6 J /.^{\circ} C$

Answer: d

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110. A centigrade and a Fehrenheit thermometer are dipped in boiling water. The water temperature is lowered until the Fehrenheit thermometer registers $140^{\circ} F$.

What is the fall in temperature as register by the centigrade thermometer

A. 80°

B. 60°

C. 40°

D. 30°

Answer: c

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111. For a certain gas the ratio of specific heats is given to be $\gamma = 15$, for this gas

A. $C_v = \frac{3R}{J}$

B. $C_p = \frac{3R}{J}$

C. $C_p = \frac{5R}{J}$

D. $C_p = \frac{5R}{J}$

Answer: b

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112. $300K$ a gas $(\gamma = 5/3)$ is compressed adiabatically so that its pressure becomes $1/8$ of the original pressure. The final temperature of the gas is :

A. $420K$

B. $300K$

C. $-142^{\circ}C$

D. $327K$

Answer: c

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113. At constant volume, temperature is increased. Then

A. collision on walls will be less

B. number of collisions per unit time will increase

C. collisions will be in straight lines

D. collisions will not change

Answer: b

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114. A polyatomic gas with (n) degress of freedom has a mean energy per molecule given by.

A. $\frac{nkT}{N}$

B. $\frac{nkT}{2N}$

C. $\frac{nkT}{2}$

D. $\frac{3kT}{2}$

Answer: c

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115. Two containers A and B are partly filled with water and closed. The volume of A is twice that of B and it contains half the amount of water in B. If both are at the same temperature, the water vapour in the containers will have pressure in the ratio of

A. $1:2$

B. $1:1$

C. $2:1$

D. $4:1$

Answer: b

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116. The first law of thermodynamics is based on the law of conservation of

A. work

B. energy

C. heat

D. All of these

Answer: b

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117. 10 gm of ice cubes at $0^\circ \mathrm{C}$ are released in a tumbler (water equivalent 55 g) at $40^\circ \mathrm{C}$. Assuming that negligible heat is taken from the surroundings, the temperature of water in the tumbler becomes nearly$(\mathrm{L} = 80\ \mathrm{cal/g})$

A. $31^\circ C$

B. $22^\circ C$

C. $19^\circ C$

D. $15^\circ C$

Answer: b

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