PHYSICS

BOOKS - RESNICK AND HALLIDAY PHYSICS (HINGLISH)

THE FIRST LAW OF THERMODYNAMICS

Sample Problem 21 1

1. A cylinder conatins 12 L of oxygen at $20^{\circ}C$ and 15 atm the temperature is raised to 35° C . And the volume is reduced to 8.5 L . What is the final pressure of the gas in atmospheres ? Assume that the gas is ideal

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2. One mole of oxygen (Assume it to be an ideal gas) expands at a constant temperature T of 310 K from an intital volume V_i of $12L$ to a final volume V_f of 19 L . How much work is done by the gas during the expansion ?

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3. Let 1.00 Kg of liquid water at $100^\circ C$ converted to steam at $100^\circ C$ by boiling at standard atmospheric pressure (which is 1.00 atm or 1.01×10^5 Pa) in the arrangement of the volume of that water changes from an initial value of $1.00 \times 10^3 m^3$ as a liquid to $2.671 \cdot 10^3 m^3$ as steam

(a) How much work is done by the system during this process ?

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4. Let 1.00 Kg of liquid water at $100^\circ C$ converted to steam at $100^\circ C$ by boiling at standard atmospheric pressure (which is 1.00 atm or 1.01×10^5 Pa) volume of that water changes from an initial value of $1.00 \times 10^3 m^3$ as a liquid to $1.671 m^3$ as steam

How much energy is transferred as heat during the process ?

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5. Let 1.00 Kg of liquid water at $100^\circ C$ converted to steam at $100^\circ C$ by boiling at standard atmospheric pressure (which is 1.00 atm or 1.01×10^5 Pa) in the arrangement of Fig 21-7 the volume of that water changes from an initial value of $1.00 \times 10^3 m^3$ as a liquid to $1.671 m^3$ as steam

(c) what is the change in the system internal energy during the process ?

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6. The P-V diagram in Fig 21-8 a represents a series of processes performed by an ideal gas , comprising a cylic process of operations . Fil in the table in Fig 21-8 b for this cycle using "+" to indicate an increase in the quantity listed "-" to indicate a decrease , and "0" to indicate no change .

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7. A bubble of 5.00 mol of helium is submerged at a certain depth in liquid water when the water (and thus the helium) undergoes a temperature increase ΔT of 20.0° C at constant pressure .As a result the bubble expands the helium is monoatomic and ideal

(a) How much energy is added to the helium as heat during the increase and expansion ?

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8. A bubble of 5.00 mol of helium is submerged at a certain depth in liquid water when the water (and thus the helium) undergoes a temperature increase ΔT of 20.0° C at constant pressure .As a result the bubble expands the helium is monoatomic and ideal

(b) what is the change ΔE_{int} in the internal energy of the helium during the temperature increase ?

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9. A bubble of 5.00 mol of helium is submerged at a certain depth in liquid water when the water (and thus the helium) undergoes a temperature increase ΔT of 20.0° C at constant pressure .As a result the bubble expands the helium is monoatomic and ideal

How much work W is done by the helium as it expands against the pressure of the surrounding water during the temperature increase ?

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10. We transfer 1000 J as heat to a diatomic gas, allowing the gas to expand with the pressure held constant. The gas molecules each rotate around an internal axis but do not oscillate. How much of the 1000 J goes into the increase of the gas's internal energy? Of that amount, how much goes into ΔK_{trans} (the kinetic energy of the translational motion of the molecules) and AK (the kinetic energy of their rotational motion)?

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11. Initially an ideal diatomic gas has pressure $p_i = 2.00 \times 10^5$ Pa and volume $V = 4.00 \times 10^3 \text{m}^3$. How much work w does it do, and what is the change ΔE_{int}, in its internal energy if it expands adiabatically to volume $V_f = 8.00 \times 10^{-6} m^3$?Throughout the process, the molecules have rotation but not oscillation.

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12. Imagine a Carnot engine that operates between the temperatures $T_H = 850K$and $T_L = 300K$. The engine performs 1200 J of work cach cycle, which takes 0.25 s.

(a) What is the efficiency of this engine?

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13. Imagine a Carnot engine that operates between the temperatures $T_H = 850K$and $T_L = 300K$. The engine performs 1200 J of work cach cycle, which takes 0.25 s.

(b) What is the average power of this engine?

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14. Imagine a Carnot engine that operates between the temperatures $T_H = 850K$and $T_L = 300K$. The engine performs 1200 J of work cach cycle, which takes 0.25 s.

(c) How much energy Q_H is extracted as heat from the high-temperature reservoir every cycle?

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15. Imagine a Carnot engine that operates between the temperatures $T_H = 850K$and $T_L = 300K$. The engine performs 1200 J of work cach cycle, which takes 0.25 s.

(d) How much energy Q_L is delivered as heat to the low-temperature reservoir every cycle?

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16. An inventor claims to have constructed an engine that has an efficiency of 75% when operated between the boiling and freezing points of water. Is this possible?

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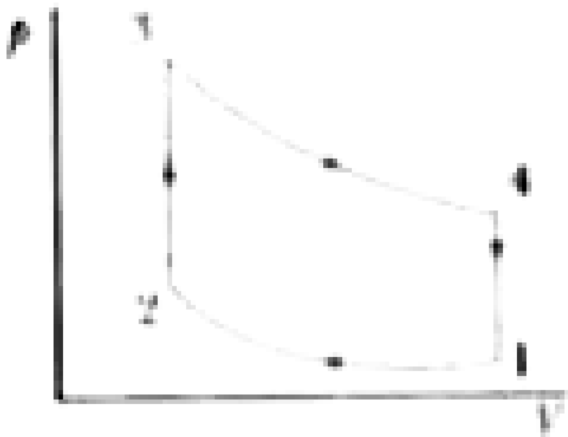
17. The cycle of a petrol engine can be approximated by an Otto cycle (Fig. 21-20a). 1 $\rightarrow$ 2 and 3 $\rightarrow$ 4 are adiabatic compression and expansion, respectively, 2 $\rightarrow$ 3 and $4 \rightarrow$ 1 are constant-volume processes. Treat the working medium as an ideal gas with constant $\gamma = C_p / C_v$, Compute the efficiency of this cycle for g = 1.4 and compression ratio, $r = V_i / V_f = 10$



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18. Find the efficiency of the Joule cycle, consisting of two adiabats and two isobars (Fig. 21-21a). The cycle is being performed between pressures P_2 and P_1 Assume the gas to be ideal and adiabatic exponent to be γ

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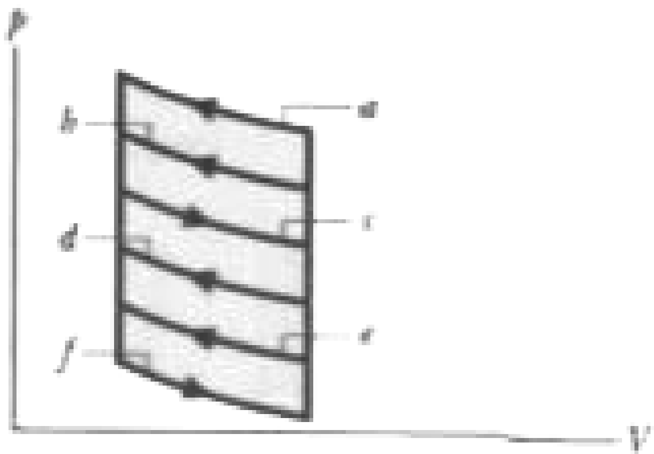
Check Point

1. The P -V diagram here shows six curved paths (connected by vertical paths) that can be followed by a gas , which two of the curved paths should be part of a closed cycle (those curved paths plus connecting vertical paths) if the net work done by the gas during the cycle is to be at its positive value ?



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2. An ideal gas has initial pressure of 3 presssure units and an initial volume units the table gives the final pressure and volume of the gas (in those same units) in five processes which processes start and end on the same isotherm ?

	a	b	c	d	e
p	12	6	5	4	1
V	1	2	7	3	12

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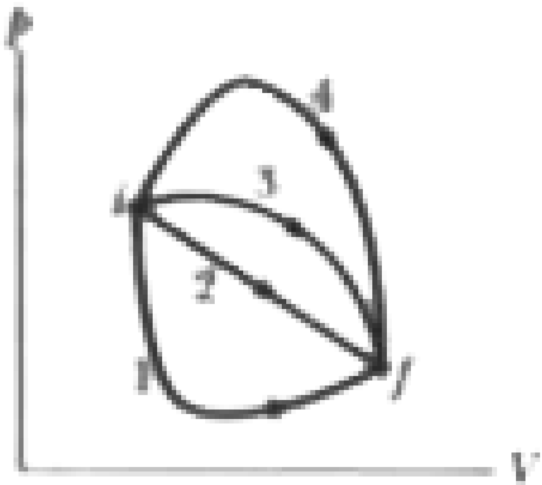
3. The figure here shows paths on a P-V diagram along which a gas can be taken from state I to state f . Rank the paths according to (a) the change $\Delta E_{\neq t}$ in the interenal energy of the fas (b) the work W done by the and (c) the magnetic of the energy transferred as heat Q between the gas and its environment , greatest first .



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4. For one complete cycle as shown in the p-V diagram here are (a) $\Delta E_{\neq t}$ for the gas and (b) the net energy transferred as heat Q positive negative or zero ?

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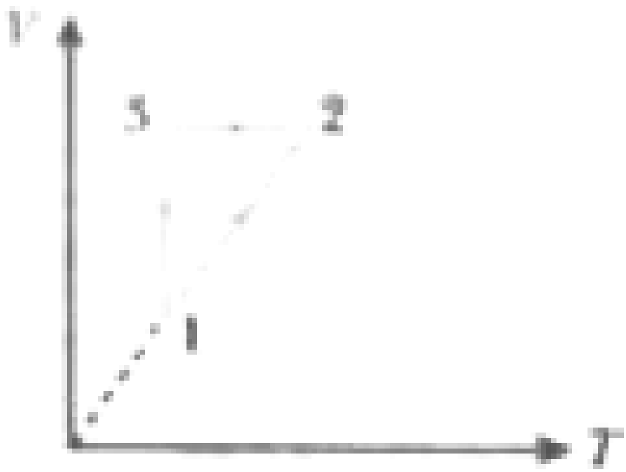
5. A cyclic process 1-2-3-1 , performed on an ideal gas is depicted in the given V-T diagam show the same process on a P-V diagram and indicate the stages when the gas receives and rejects heat .



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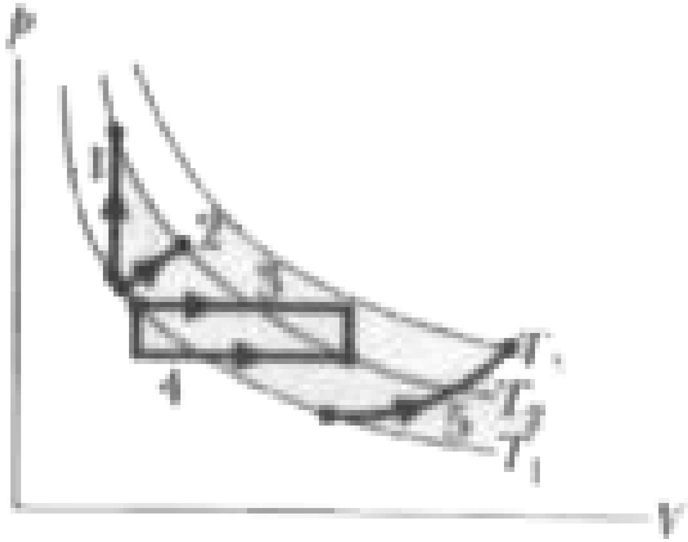
6. The figure here five paths traversed by a gas on a p-V diagram .Rank the paths according to the change in internal energy of the gas , greatest first .



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7. Rank paths 1,2 and 3 in fig 21 .14 according to the energy transfer to the gas as heat , greatest first .

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8. Three carnot engines operate between reserviour temperature of (a) 400 and 500 K (b) 600 and 800 K and (c) 400 and 600 K . Rank the

engines according the their thermal efficiencies greater first .

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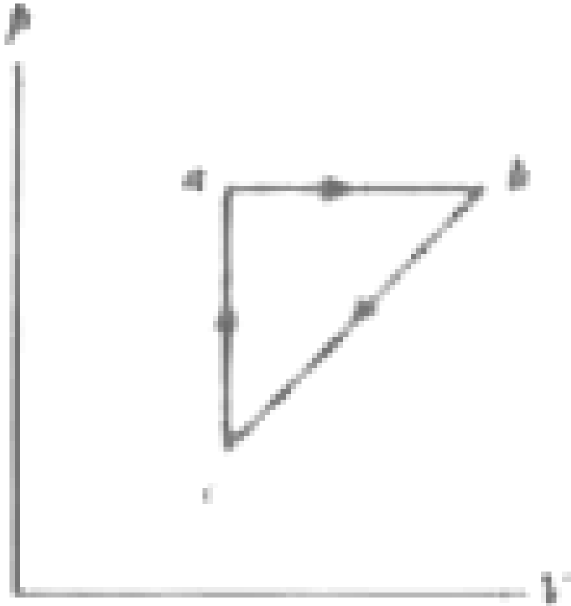
Problems

1. A lab sample of gas is taken through cyclic abca shown in the P-V diagram of fig 21-22 the net work done is + 1.5 J . Along paths Ab the change in the internal energy is +3.0 and the magnitude of the work done is 5.0 J Along path ca the energy transferred to the gas as heat is + 2.5 J . How much energy is transferred as heat along (a) path ab and (b) path bc

?



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2. When a system is taken from state I to state f along path iaf in fig - 21.23 Q = 100 cal and W = 40 cal Along path ibf Q = 72 cal . (a) what is W along path ibf ?

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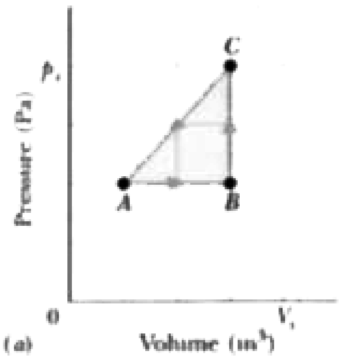
3. The themodynamic system is taken from state A to state B to state C , and then back from state A to p-V diagram of fig - 21.24 a . The vertical scale is set by $p_s = 20\text{Pa}$ and the table in fig . 21-24 by inserting a plus sign a minus sign or a zero in each indicated cell . (h) what is the set work done by the system as it moves once through the cycle ABCA ?



(b)

	Q	W	ΔE_{int}
$A \to B$	(a)	(b)	+
$B \to C$	+	(c)	(d)
$C \to A$	(e)	(f)	(g)

Figure 21-24 Problem 3.

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4. suppose 200 J of work is done on a system and 80.0 cal is extracted from the system as heat . In the sence of the first law of thermodynamics what are the values (including algbraic signs) of (a) W ,(b) Q m and (c) ΔE_{int}?

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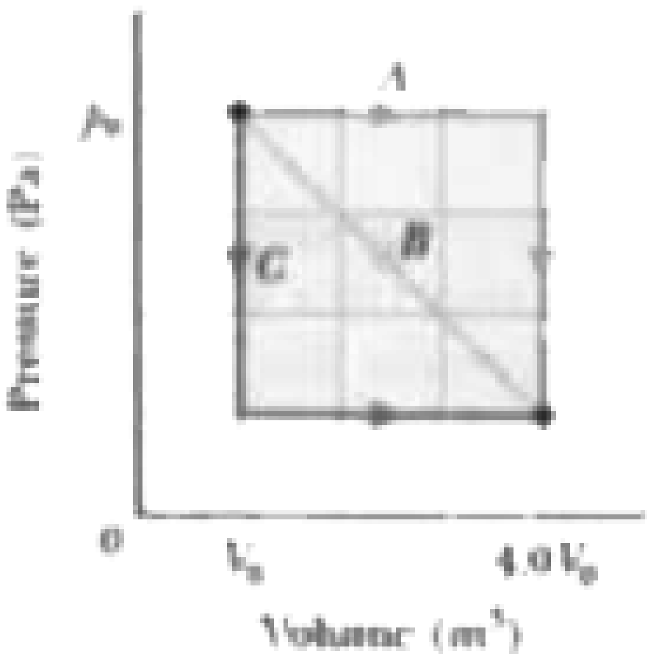
5. In fig - 21.25 a gas sample expands from V_0 to $4.0V_0$ while its pressure decrease from p_0 to $P_0/4.0$ .if $V_0 = 1.0m^3$ and $p_0 = 60Pa.$ how much work is done by the gas if its pressure changes with volume via (a) path A . (b) path b, and (c) path c ?



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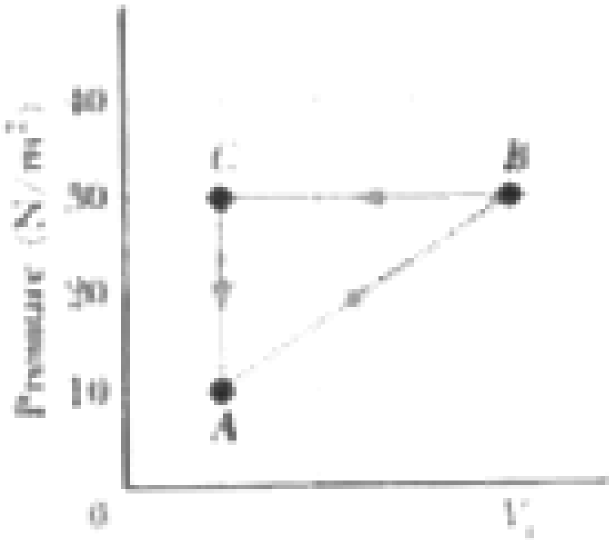
6. A gas within a closed chamber undergoes the cycle shown in the p-V diagram of Fig. 21-26. The horizontal scale is set by $V_s = 8.0 m^3$. Calculate the net energy added to the system as heat during one complete cycle.



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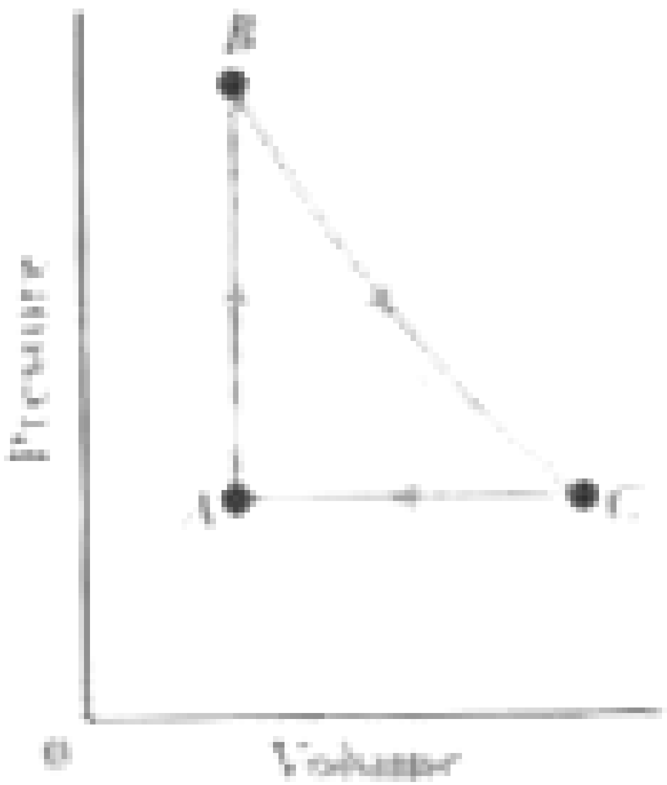
7. As a gas is held within a closed chamber, it passes through the cycle shown in Fig. 21-27 Determine the energy transferred by the system as heat during constant-pressure process CA if the energy added as heat Q_{AB} during constant-volume process AB is 25.0 J, no energy is transferred as heat during adiabatic process BC and the net work done during the cycle is 15.0 J.



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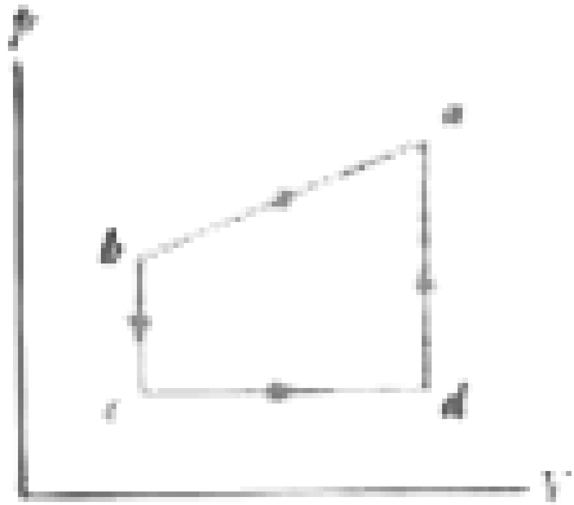
8. Figure 21-28 represents a closed cycle for a gas (the figure is not drawn to scale). The change in the internal energy of the gas as it moves from a to calong the path abc is -50 J. As it moves from c to d, 45 J must be transferred to it as heat. An additional transfer of 20 J to it as heat is needed as it moves from d to a. How much work is done on the gas as it moves from c to d?



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9. Calculate the specific heat of a metal from the following data. A container made of the metal has a mass of 3.6 kg and contains 15 kg of water. A 1.8 kg piece of the metal initially at a temperature of $180^\circ C$ is dropped into the water. The container and water initially have a temperature of $16.0^\circ C$, and the final temperature of the entire (insulated) system is $18.0^\circ C$.

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10. When 0.40 mol of oxygen (O_2) gas is heated at constant pressure starting at 0°C, how much energy must be added to the gas as heat to triple its volume? (The molecules rotate but do not oscillate.)

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11. A gas is to be expanded from initial state i to final state f along either path 1 or path 2 on a p-V diagram. Path 1 consists of three steps: an isothermal expansion (work is 23 J in magnitude), an adiabatic expansion (work is 35 J in magnitude), and another isothermal expansion (work is 16 J in magnitude). Path 2 consists of two steps: a pressure reduction at constant volume and an expansion at constant pressure . what is the change in the internal energy of gas along path 2 ?

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12. When 22.5 J was added as heat to a particular ideal gas, the volume of the gas changed from 50.0 cm^3 to 100 cm^3 while the pressure remained at 1.00 atm. (a) By how much did the internal energy of the gas change? If the quantity of gas present was 2.00×10^{-3}mol, find (b)C_p and (c) C_v

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13. Suppose 2.80 mol of an ideal diatomic gas, with molecular rotation but not oscillation, experienced a temperature increase of 45,0 K under constant-pressure conditions. What are (a) the energy transferred as heat , (b) the change ΔE_{int} internal energy of the gas, (c) the work w done by the gas, and (d) the change ΔK in the total translational kinetic energy of the gas?

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14. The temperature of 4.50 mol of an ideal monatomic gas is raised 27.0 K at constant volume. What are (a) the work W done by the gas, (b) the energy transferred as heat Q. (c) the change ΔE_{int} in the internal energy of the gas, and (d) the change ΔK in the average kinetic energy per atom?

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15. Opening champagne. In a bottle of champagne, the pocket of gas (primarily carbon dioxide) between the liquid and the cork is al pressure of p_i = 4.00 atm. When the cork is pulled from the bottle, the gas undergoes an adiabatic expansion until its pressure matches the ambient air pressure of 1.00 atm. Assume that the ratio of the molar specific heats is γ= 4/3. If the gas has initial temperature $T = 5.00^\circ C$, what is its temperature at the end of the adiabatic expansion?

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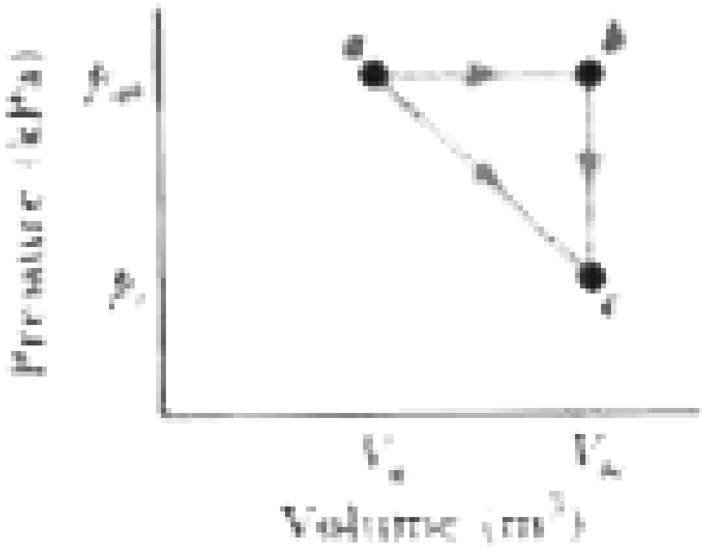
16. One mole of an ideal diatomic gas goes from a to c along the diagonal path in Fig. 21-29. The scale of the vertical axis is set by $P_{ab} = 5.0kPa$ and $p_c = 0.50kPa$, and the scale of the horizontal axis is set by $V_a = 2.0m^3$ During the transition, (a) what is the change in internal energy of the gas, and (b) how much energy is added to the gas as heat? (c) How much heat is required if the gas goes from a to c along the indirect path abc?



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17. Adiabatic wind. The normal airflow over the Rocky Mountains is west to east. The air loses much of its moisture content and is chilled as it climbs the western side of the mountains. When it descends on the eastern side, the increase in pressure toward lower altitudes causes the temperature to increase. The flow, then called a chinook wind, can rapidly raise the air temperature at the base of the mountains. Assume that the air pressure p depends on altitude y according to $p = P_0$ exp (-ay), where $P_0 = 1.00$ atm and a =1.16×10^{-4}m. Also assume that the ratio of the molar specific heats is γ= 4/3. A parcel of air with an initial temperature of -13.0°C descends adiabatically from $Y_1 = 4267$m to y = 1567 m. What is its temperature at the end of the descent?

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18. We give 90 J as heat to a diatomic gas, which then expands at constant pressure. The gas molecules rotate but do not oscillate. By how much does the internal energy of the gas increase?

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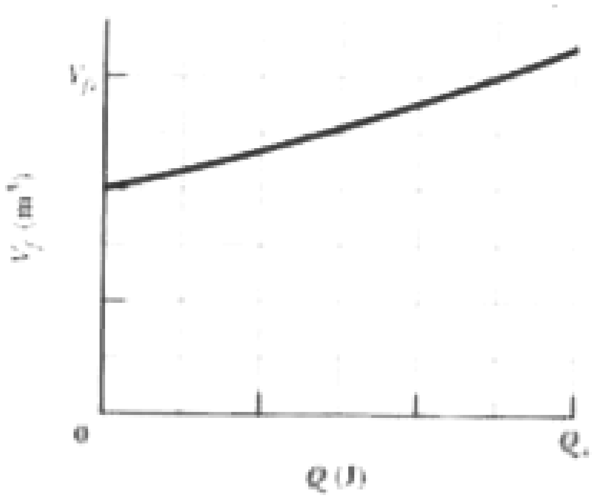
19. Suppose 0.825 mol of an ideal gas undergoes an isothermal expansion as energy is added to it as heat Q. If Fig. 21-30 shows the final volume V_f versus Q, what is the gas temperature? The scale of the vertical axis is set by $V_{fs} = 0.30m^3$ and the scale of the horizontal axis is set by

$Q_s = 1800J$.



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20. Figure 21-31 shows a cycle undergone by 2.00 mol of an ideal monatomic gas. 2. The temperatures are $T_1 = 300K, T_2 = 600K,$ and $T_3 = 455K$. For 1 $\rightarrow$ 2, what are (a) heat Q, (b) the change in internal energy ΔE_{int}, . and (c) the work done W? For $2 \rightarrow 3$. what are (d) Q. (e) ΔE_{int}, and (f) W? For $3 \rightarrow 1$, what are (g) (h) ΔE_{int}, and (i) W? For the full cycle, what are (j)(k) ΔE_{int}, and (1) W? The initial pressure at point 1 is 1.00 atm (= 1.013 10% Pa). What are the (m) volume and (n) pressure at point 2 and the (o) volume and (p) pressure at point 3?

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21. An ideal diatomic gas, with rotation but no oscillation,undergoes an adiabatic compression. Its initial pressure and volume are 1.20 atm and 0.200 m . Its final pressure is 3.60 atm. How much work is done by the gas?

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22. The volume of an ideal gas is adiabatically reduced from 350 L to 130 L. The initial pressure and temperature are 2.00 atm and 380 K. The final pressure is 8.00 atm. (a) is the gas monatomic, diatomic, or polyatomic? (b) What is the final temperature? (c) How many moles are in the gas?

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23. Under constant pressure, the temperature of 3.00 mol of an ideal monatomic gas is raised 15.0 K. What are (a) the work W done by the gas, (b) the energy transferred as heat Q. (c) the change ΔE_{int} in the internal energy of the gas, and (d) the change ΔK in the average kinetic energy per atom?

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24. An automobile tire has a volume of $1.64 \times 10^2 m^3$ and contains air at a gauge pressure (pressure above atmospheric pressure) of 165 kPa when the temperature is 0.00°C. What is the gauge pressure of the air in the tires when its temperature rises to 37.0°C and its volume increases to $1.67 \times 10^{-2} m^4$ Assume atmospheric pressure is 1.01×10^5 Pa.

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25. Suppose 1.00 L of a gas with γ= 1.30, initially at 285 K and 1.00 atm, is suddenly compressed adiabatically to half its initial volume. Find its final (a) pressure and (b) temperature. (C) If the gas is then cooled to 273 K at constant pressure, what is its final volume?

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26. A certain gas occupies a volume of 0.76 L at a pressure of 1.2 atm and a temperature of 4000 K. It is expanded adiabatically to a volume of 4.3 L.

Determine (a) the final pressure and (b) the final temperature, assuming the gas to be an ideal gas for which γ = 1.4.

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27. The mass of a gas molecule can be computed from its specific heat at constant volume c_V. (Note that this is not C_V) Take $c_v = 0.1476 cal / g^\circ C$ for neon and calculate (a) the mass of a neon atom and (b) the molar mass of neon.

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28. Air that initially occupies 0.280 m at a gauge pressure of 103.0 kPa is expanded isothermally to a pressure of 101.3 kPa and then cooled at constant pressure until it reaches its initial volume. It then returns to its initial pressure in a constant-volume process. Compute the network done by the air. (Gauge pressure is the difference between the actual pressure and atmospheric pressure.)

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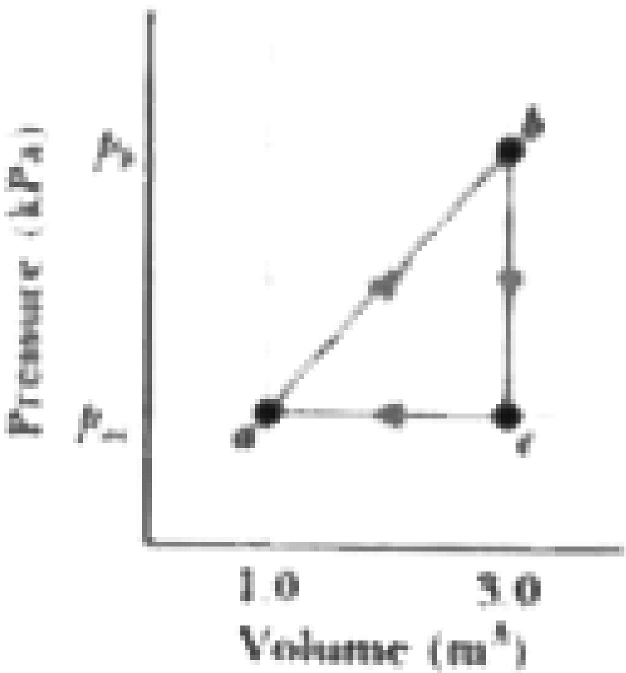
29. A sample of an ideal gas is taken through the cyclic process abca shown in Fig.21-33. The scale of the vertical axis is set by $p_b = 7.5kPa$and $p_{Ac} = 2.5kPa$. At point a, T = 280 K. (a) How many moles of gas are in the sample? What are (b) the temperature of the gas at point b, (c) the temperature of the gas at point c, and (d) the Higure 21-33 Problem 30. net work done by the gas during the cycle, and (c) the net energy added to the gas as heat during the cycle?



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30. Suppose 1.80 mol of an ideal gas is taken from a volume of 3,00 m^3 to a volume of $5.50m^3$ via an isothermal expansion at $30^\circ C$. (a) How much energy is transferred as heat during the process, and (b) is the transfer to or from the gas?

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31. A Carnot engine has an efficiency of 15.0%. It operates between constant temperature reservoirs differing in temperature by 55.0°C What is the temperature of the lower-temperature reservoir?

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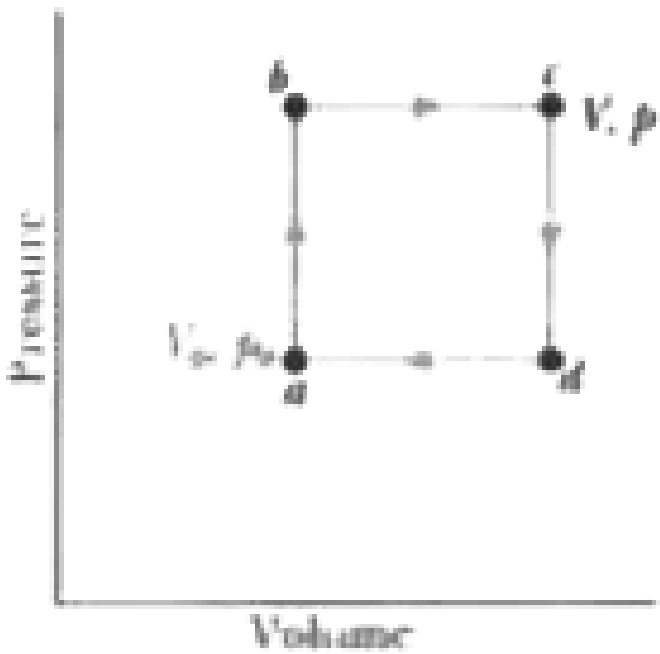
32. Figure 21-34 shows a reversible cycle through which 1.00 mol of a monatomic ideal gas is taken. Assume that $p = 2p_0V = 2V_0, P_0 = 1.01 \times 10^5$ Pa, and $V_0 = 0.0335m^3$. Calculate (a) the work done during the cycle, (b) the energy added as heat during stroke Volume abc, and (c) the efficiency of the cycle. (d) What is the efficiency of a Carnot engine operating between the highest and lowest temperatures that occur in the cycle?



33. A Carnot engine whose high-temperature reservoir is at 483 K has an efficiency of 40%. By how much should the temperature of the low-temperature reservoir be decreased to increase the efficiency to 50%?

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34. In a hypothetical nuclear fusion reactor, the fuel is deuterium gas at a temperature of7×10^8 K. If this gas could be used to operate a Carnot engine with $T_L = 50^\circ C$, what would be the engine's efficiency? Take both temperatures to be exact and report your answer to eight significant figures.

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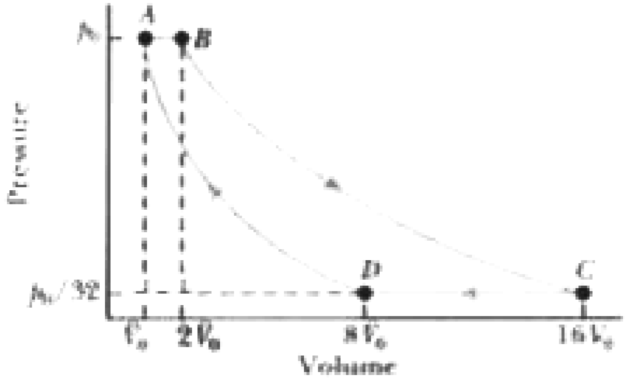
35. An ideal gas (3.0 mol) is the working substance in an engine that operates on the cycle shown in Fig. 21-35. Processes BC and DA are reversible and adiabatic. (a) Is the gas monatomic, diatomic, or polyatomic? (b) What is the engine efficiency?



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36. (a) During each cycle, a Carnot engine absorbs 730 J as heat from a high-temperature reservoir at 360 K, with the low-temperature reservoir at 280 K. How much work is done per cycle? (b) The engine is then made to work in reverse to function as a Carnot refrigerator between those same two reservoirs. During each cycle, how much work is required to remove 1200 J as heat from the low-temperature reservoir?

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37. (a) For 2.5 mol of a monatomic ideal gas taken through the cycle in Fig. 21-36, where $V_1 - 4.00V_0$, what is $W / p_0 V_0$ as the gas goes from state a to state c along path abc?

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38. A 600 W Carnot engine operates between constant temperature reservoirs at 100° C and $60.0^\circ C$. What is the rate at which energy is (a) taken in by the engine as heat and (b) exhausted by the engine as heat?

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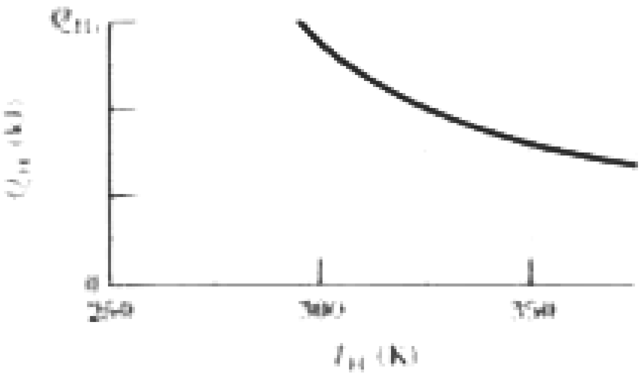
39. A Carnot engine is set up to produce a certain work W per cycle. In each cycle, energy in the form of heat $Q_H$is transferred to the working substance of the engine from the higher-temperature thermal reservoir, which is at an adjustable temperature T_H. The lower-temperature thermal reservoir is maintained at temperature $T_L = 250K$. Figure 21-37 gives $Q_H$for a range of T_H The scale of the vertical axis is set by Q_Hs =

12.0 kJ. If T_H is set at 550 K, what is Q_H?



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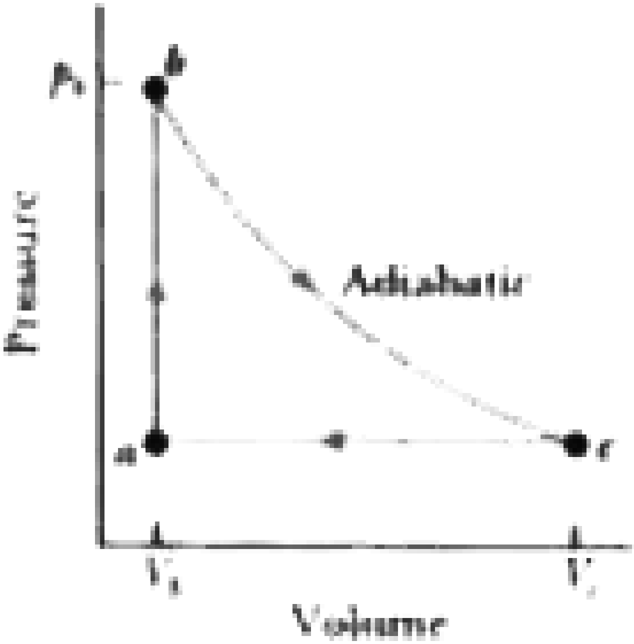
40. Figure 21-38 shows a reversible cycle through which 1.00 mol of a monatomic ideal gas is taken. Volume V_C = 8.00 V_b Process Adiabatic bc is an adiabatic expansion, with $p_b = 5.00$ atm and $V_b = 1.00 \times 10^{-3} m^3$. For the cycle, find (a) the energy added to the gas as heat, (b) the energy leaving the gas as Volume heat, (c) the network done by the gas, and (d) the efficiency of the cycle.



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41. A Carnot engine operates between $235^{\circ}C$ and $115^{\circ}C$, absorbing 3.00×10^{4} J per cycle at the higher temperature. (a) How much energy per cycle is discharged at the lower temperature? (b) How much work per cycle is this engine capable of performing?

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Practice Questions Single Correct Choice Type

1. which statement is incorrect ?

A. All reversible cycles have same efficiency

B. Reversible cycle has more efficiency than an irreversible one .

C. Carnot cycle is a reversible one .

D. Carnot cycle has the maximum efficiency in all moles

Answer: A

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2. A mixture of n_1 moles of monoatomic gas and n_2 moles of diatomic gas has $\gamma = 1.5$

A. $n_1 = n_2$

B. $2n_1 = n_2$

C. $n_1 = 2n_2$

D. $2n_1 = 3n_2$

Answer: A

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3. The molar heat capacity for an ideal gas

A. cannot be negative.

B. must lie in the range starting from C_V and terminating at C_p that is, $C_V \leq C \leq C_p$

C. must equal either C_p or C_v

D. may have any value lying between $-\infty$ and ∞,

Answer: A

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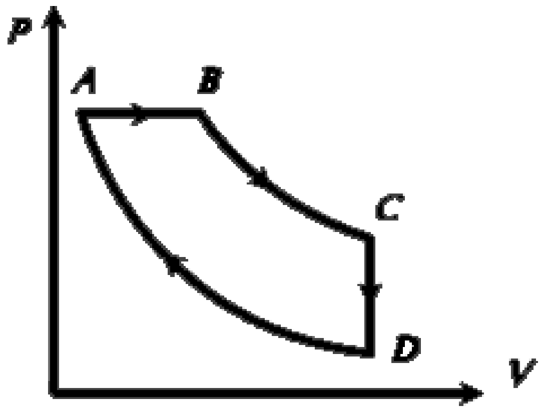
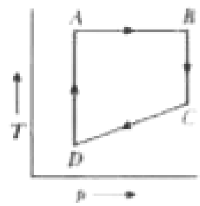
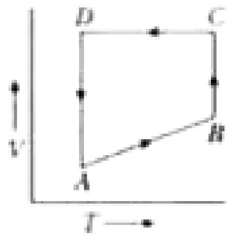
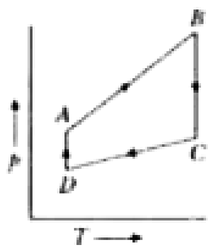
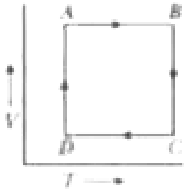
4. A cyclic process ABCD is shown in the figure P - V diagram. Which of the following curves represent the same process



A. 

B. 

C. 

D. 

Answer: B

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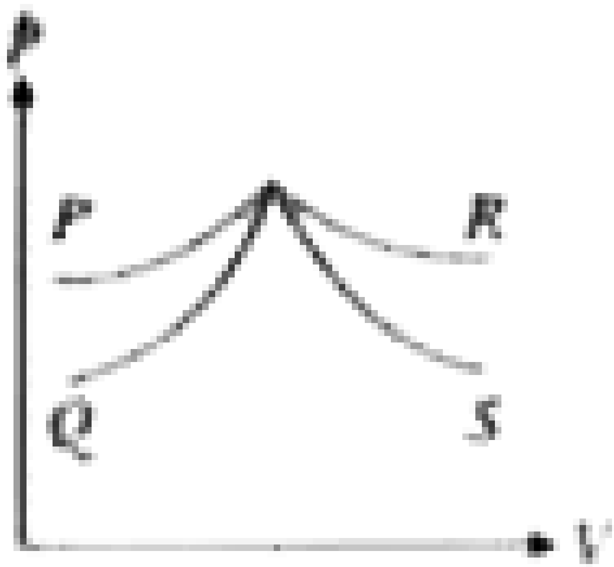
5. The given figure shows four p-V diagrams for the given sample of gas. In which case, no exchange of heat occurs with the sample?



A. P

B. Q

C. R

D. S

Answer: D

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6. A gas is contained in a metallic cylinder fitted with a piston.The piston is suddenly moved in to compress the gas and is maintained at this position. As time passes the pressure of the gas in the cylinder

A. increases

B. decreases

C. remains constant

D. increases or decreases depending on the nature of the gas.

Answer: B

Watch Video Solution

7. How much work to be done in decreasing the volume of an ideal gas by an amount of $2.4 \times 10^{-4} m^3$ at constant normal pressure of $1 \times 10^5 N / m^2$?

A. 24J

B. 25 J

C. 27 J

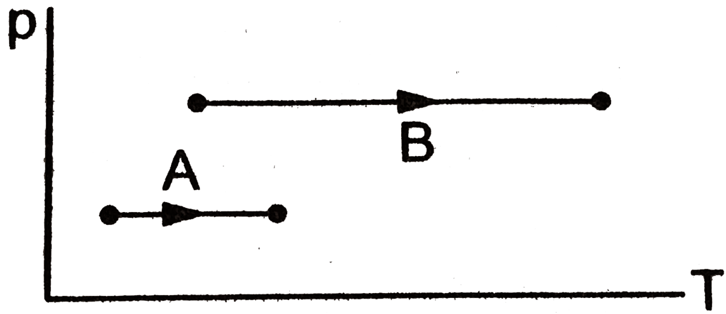
D. 28 J

Answer: A

Watch Video Solution

8. Consider two processes on a system as shown in figure.

The volumes in the initial states are the same in the two processes and the volume in the final states are also the same.Let ΔW_1 and ΔW_2 be the work done by the system in the processes A and B respectively.



A. $\Delta W_1 > \Delta W_2$

B. $\Delta W_1 = \Delta W_2$

C. $\Delta W_1 < \Delta W_2$

D. Nothing can be said about relation between ΔW_1 and ΔW_2

Answer: C

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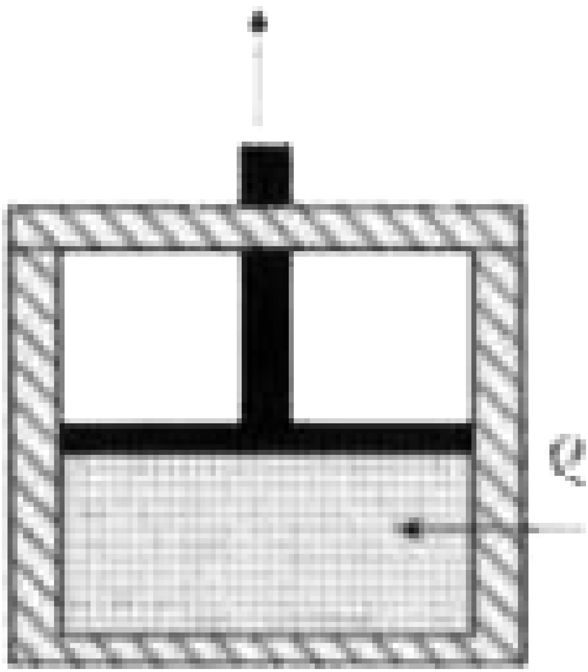
9. When the gas enclosed beneath the piston shown in the figure receives 1930 J of heat, Q, from its surroundings, it performs 2250 J of work in raising the piston. What is the change in the internal energy of the gas?



A. $-320J$

B. $+320J$

C. $-4180J$

D. $+4180J$

Answer: A

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10. A gas is compressed at a constant pressure of $50N/m^2$ from a volume $10m^3$ to a volume of $4m^3$. 100J of heat is added to the gas then its internal energy is

A. increased by 400 J

B. increased by 200 J

C. increased by 100J

D. decreased by 200 J

Answer: A

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11. Two samples A and B are initially kept in the same state. The sample A is expanded through an adiabatic process and the sample B through an isothermal process. The final volumes of the samples are the same .The final pressures in A and B are p_A and P_B respectively.

A. $P_A > P_B$

B. $P_A = P_b$

C. $P_A < P_B$

D. the relation between P_A and P_B cannot be deduced

Answer: C

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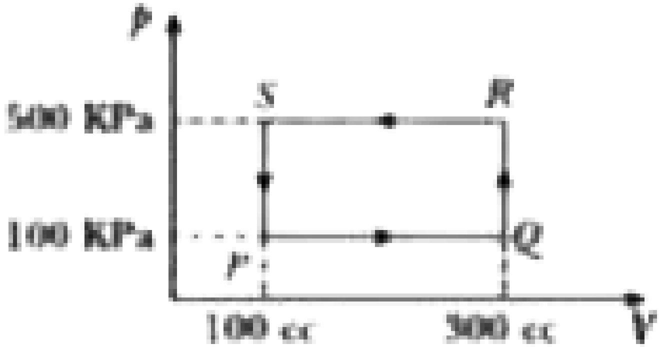
12. A thermodynamic system is taken through the cyclic PORSP process (see figure). The net work done by the system is



A. 20 J

B. $-80J$

C. $400J$

D. $-374J$

Answer: B

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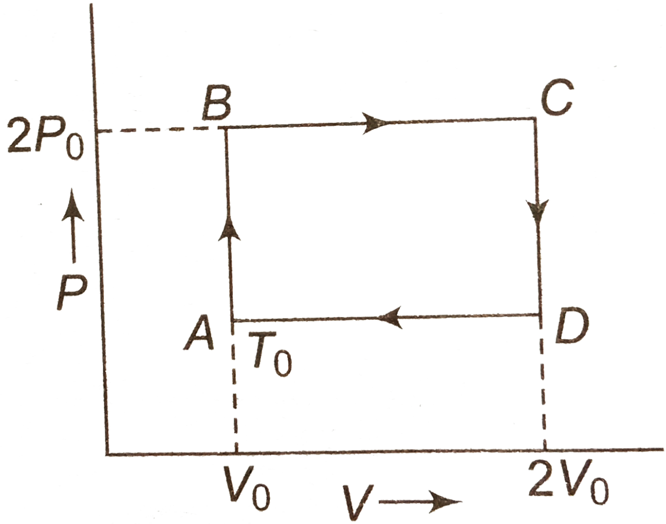
13. N moles of a monoatomic gas is carried round the reversible rectangular cycle $ABCDA$ as shown in the diagram. The temperature at A is T_0

The thermodynamic efficiency of the cycle is :



A. 0.15

B. 0.5

C. 0.2

D. 0.25

Answer: A

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14. In a given process on an ideal gas, $dW = 0$ and $dQ < 0$. Then for the gas

A. the temperature will decrease.

B. the volume will increase.

C. the pressure will remain constant.

D. the temperature will increase.

Answer: A

Watch Video Solution

15. A match ignites within in an oxygen-filled cylinder that has a movable piston. The piston is moved so quickly that no heat escapes. What kind of change is demonstrated in this process?

A. An isobaric change

B. An adiabatic change

C. An isochoric change

D. A change of heat capacity

Answer: B

View Text Solution

16. Ideal gas undergoes an adiabatic change in its state from (P_1V_1, T_1) to$(, P_2, V_2T_2)$. The work done (W) in the process is (n = number of moles, C_p and C_v are molar specific heats of gas)

A. $W = n(T_1 - T_2)C_P$

B. $W = n(T_1 - T_2)C_v$

C. $W = n(T_1 + T_2)C_p$

D. $W = n(T_1 + T_2)C_V$

Answer: B

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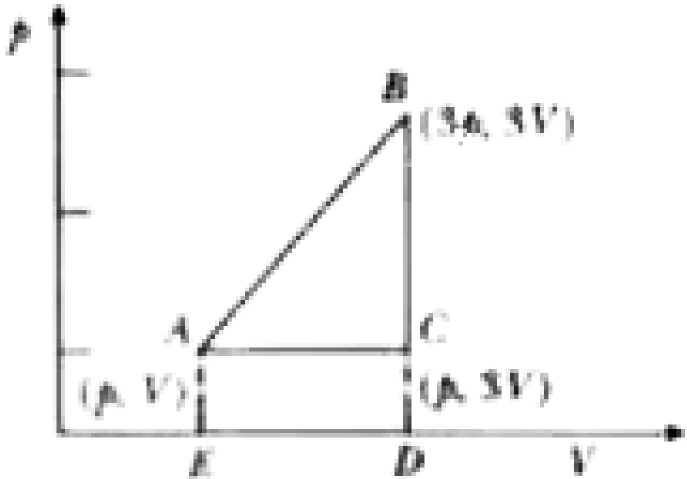
17. An ideal gas is taken around ABCA as shown in the p-V diagram (below). The work done during a cycle is



A. $2pV$

B. pV

C. $1/2pV$

D. zero

Answer: A

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18. Work done by 0.1 mole of a gas at $27^{\circ}C$ to double its volume at constant pressure is (use R=2 cal/mol $^{\circ}$ C)

A. 54 cal

B. 600 cal

C. 60 cal

D. 546 cal

Answer: C

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19. A thermally isolated sample of an ideal gas at a fixed temperature is confined to one half of a container by an impermeable membrane. The other half of the container is evacuated. The membrane is then pierced and the gas is allowed to expand freely and to double its volume as shown. Which one of the following statements is true concerning this situation?

A. The process is reversible.

B. This is an isothermal process.

C. The entropy of the gas decreases.

D. The internal energy of the gas must decrease.

Answer: B

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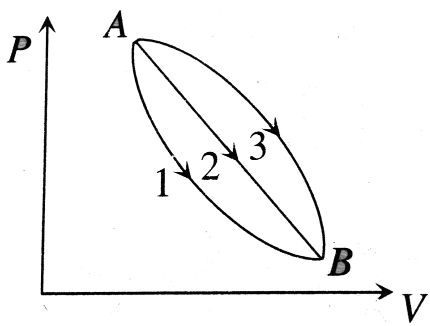
20. An ideal gas of mass m in a state A goes to another state B via three different processes as shown in Fig. If Q_1, Q_2 and Q_3 denote the heat absorbed by the gas along the three paths, then



A. $Q_1 < Q_2 < Q_3$

B. $Q_1 < Q_2 = Q_3$

C. $Q_1 = Q_2 > Q_3$

D. $Q_1 > Q_2 > Q_3$

Answer: A

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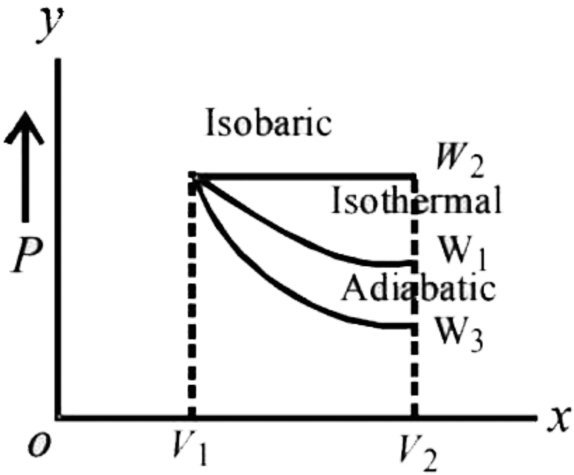
21. Starting with the same initial conditions, an ideal gas expands from volume $V_1 \rightarrow V_2$ in three different ways. The work done by the gas is W_1 if the process is purely isothermal, W_2if purely isobaric and W_3 if purely adiabatic. Then



A. $W_1 > W_2 > W_3$

B. $W_2 > W_3 > W_1$

C. $W_3 > W_2 > W_1$

D. $W_2 > W_1 > W_3$

Answer: D

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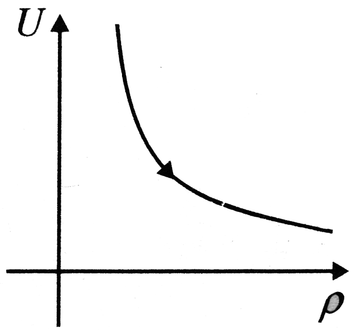
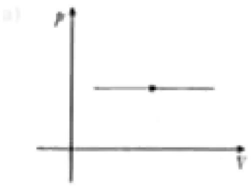
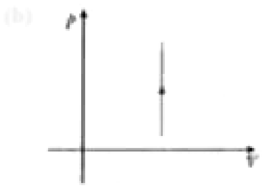
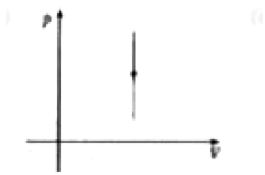
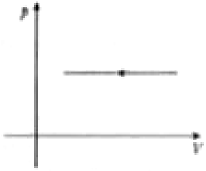
22. Variation of internal energy with density of $1 \mathrm{mole}$ of monatomic gas is depicted in Fig. Corresponding variation of pressure with voluem can be depicted as (assume the curve is rectangular hyperbola)



A. 

B. 

C. 

D. 

Answer: D

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23. The pressure P, Volume V and temperature T of a gas in the jar A and the other gas in the jar B at pressure $2P$, volume $V/4$ and temperature $2T$, then the ratio of the number of molecules in the jar A and B will be

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: D

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24. A Carnot engine operates between hot and cold reservoirs with temperatures $527^\circ C$ and $-73.0^\circ C$, respectively. If the engine performs 1000.0 J of work per cycle, how much heat is extracted per cycle from the hot reservoir?

A. 878J

B. 133J

C. 1163 J

D. 1527 J

Answer: B

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25. In an adiabatic change, the pressure and temperature of a monoatomic gas are related with relation as $P \propto T^C$, Where C is equal to:

A. $5/2$

B. $5/3$

C. $2/5$

D. $3/5$

Answer: A

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26. Neon is a monatomic gas with a molar heat capacity at constant volume of 12.66 J/(mol K). Two moles of neon gas enclosed in a constant volume system receive 5250 J of heat. If the gas was initially at 293 K, what is the final temperature of the neon?

A. 200 K

B. 300 K

C. 400 K

D. 500 K

Answer: D

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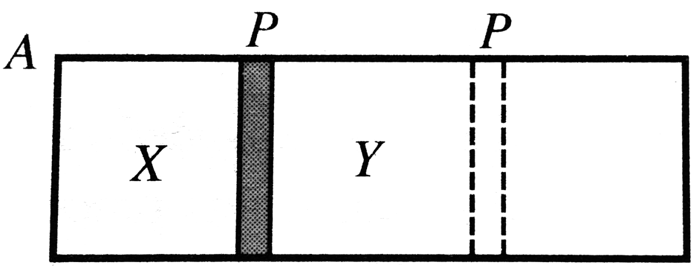
27. A cylindrical chamber A of uniform cross section is divided into two parts X and Y by a movalbe piston P which can slide without friction inside the chamber. Initially part X contains 1mol of a monochromatic gas and Y contains $2mol$ of a diatomic gas, and the volumes of X and Y are in the ratio $1:2$ with both parts X and Y being at the same temperature T. Assuming the gases to be ideal, the work W that will be done in moving the piston slowly to the position where the ratio of the volumes of X and Y is $2:1$ will be



A. $-5.8T$

B. $8.3T$

C. $12.3T$

D. zero

Answer: A

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28. Determine the quantity of heat added to 3.5 moles of the ideal gas argon if the temperature increases from $75^\circ C$ to $225^\circ C$ during an isobaric process .

(the molar specific of argon are $C_v = 3.0cal / Kmol$ and $C_P = 5.0cal / Kmol$)

A. 2600 cal

B. 1600 cal

C. 21 00 cal

D. 1100 cal

Answer: A

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29. 175 calories of heat is reuired to raise the temperature of 5 mol of an ideal gas at constant pressure from $20^\circ C$ to $25^\circ C$ the amount of heat required to raise the temperature of same gas from $20^\circ C$ to $25^\circ C$ at constant volume will be

A. 100 cal

B. 125 cal

C. 150 cal

D. 175 cal

Answer: B

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30. If one complete cycle of a reversible process is carried out on a sample of an ideal so that its final state is the same as its initial state , which one of the following quantities is the only one which can be non - zero ?

A. The change in volume of the sample

B. the net heat absorbed by the sample

C. the change in the entropy of the example

D. the change in temperature of the sample

Answer: A

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31. The efficiency of a heat engine working between the freezing point and boiling point of water is

A. 0.27

B. 0.61

C. 0.49

D. 0.85

Answer: A

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32. Two cylinders A and B fitted with pistons contain equal amounts of an ideal diatomic gas at 300K. The piston of A is free to move, while that B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is 30K, then the rise in temperature of the gas in B is

A. 30 K

B. 18K

C. 50 K

D. 42 K

Answer: D

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33. An ideal monatomic gas undergoes an adiabatic process , and its internal energy increases by 50 J which pair of choices below is correct for this process ?

	Work done	Heat exchanged
(a)	50 J by the system	zero joules
(b)	50 J on the system	zero joules
(c)	50 J by the system	100 J supplied
(d)	zero joules	50 J removed

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34. An enegine is used to lift a 2700 kg truck to a height of 3.0 m at constant speed . In the lifting process , the engine received 3.3×10^5 J of heat from the fuel burned in its interior . What is the efficiency of the engine ?

A. 0.19

B. 0.29

C. 0.24

D. 0.34

Answer: C

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35. The slope of isothermal and adiabatic curves are related as

A. isothermal curve slope = adiabatic curve slope

B. isothermal curve slope = $\gamma \times$ adiabatic slope

C. adiabatic curve slope = $\gamma \times$ isothermal slope

D. adiabatic curve slope = (1/2) $\times$ isothermal curve slope

Answer: C

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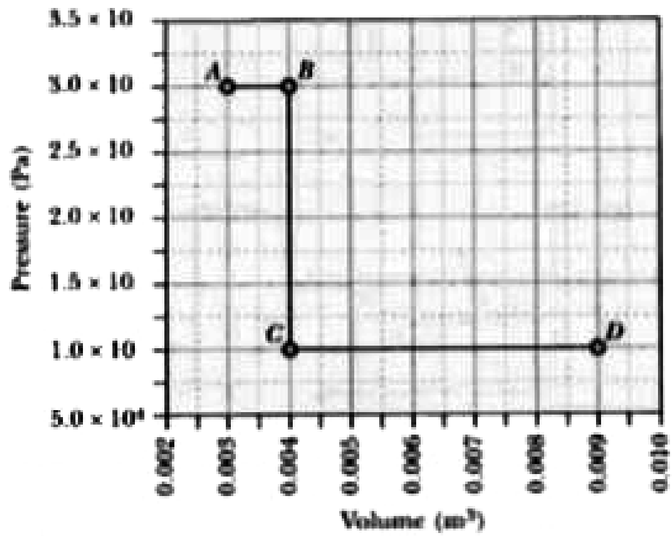
36. Two moles of a confined ideal monatomic gas begin at state A in the pressure-volume graph and follow the path shown to state D. If the temperature of the gas at A is 54 K, what is the temperature of the gas at D?



A. 32 K

B. $46K$

C. $54K$

D. $60K$

Answer: C

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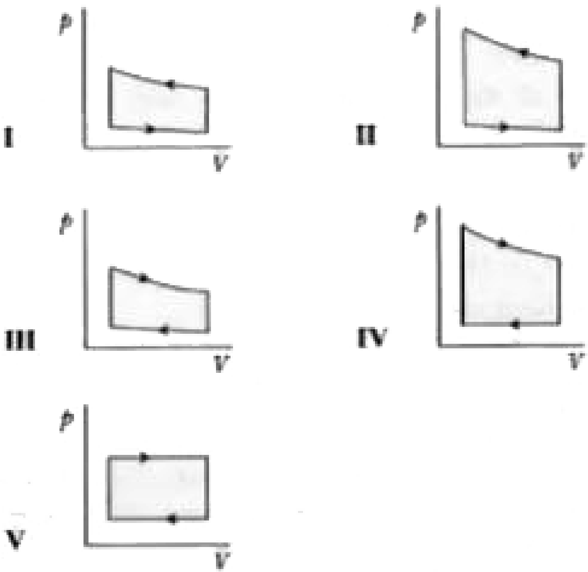
37. Pressure vs. volume graphs for a certain gas undergoing five different cyclic processes are shown below. During which cycle does the gas do the greatest positive work?



A. I

B. II

C. III

D. IV

Answer: D

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38. In an adiabatic process

A. the energy absorbed as heat equals the work done by the system on its environment.

B. the energy absorbed as heat equals the work done by the environment on the system.

C. the energy absorbed as heat equals the change in internal energy.

D. the work done by the environment on the system equals the change in internal energy.

Answer: D

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39. A jogger's internal energy changes because he performs 6.4×10^5 J of work and gives off 4.9×10^5 of heat. However, to cause the same change in his internal energy while walking, he must do 8.2×10^5 J of work. Determine the magnitude of the heat given off while walking.

A. $3.6 \times 10^5 J$

B. $4.0 \times 10^5 J$

C. $2.4 \times 10^5 J$

D. $3.1 \times 10^5 J$

Answer: D

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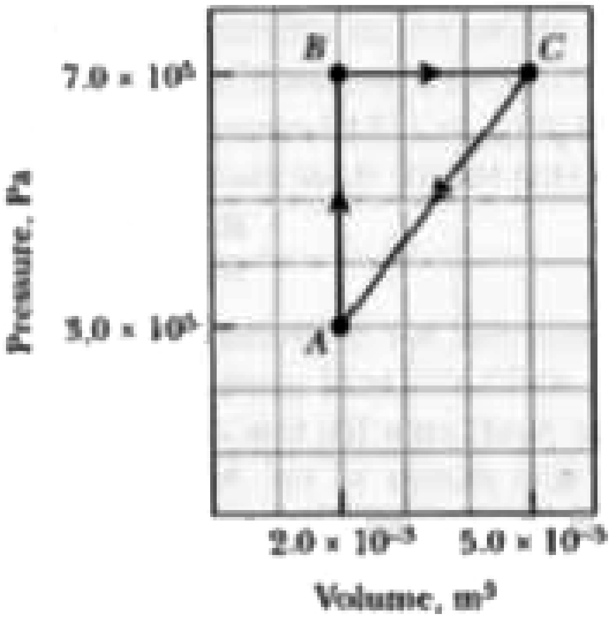
40. The pressure and volume of a gas are changed along the path ABCA. Using the data shown in the graph, determine the work done (including the algebraic sign) in each segment of the path B to C.



A. $-1.5 \times 10^3 J$

B. $+1.5 \times 10^3 J$

C. $-2.1 \times 10^3 J$

D. $+2.1 \times 10^3 J$

Answer: D

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41. The temperature of a monatomic ideal gas remains constant during a process in which 4700 J of heat flows out of the gas. How much work (including the proper + or - sign) is done?

A. zero J

B. $+9400J$

C. $+4700J$

D. $-4700J$

Answer: D

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42. Heat is added isothermally to 2.5 mol of a monatomic ideal gas. The temperature of the gas is 430 K. How much heat must be added to make the volume of the gas double?

A. 5500 J

B. 3100 J

C. 6700 J

D. 2700 J

Answer: C

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43. One mole of a monatomic ideal gas has an initial pressure, volume, and temperature of P_0, V_0, and 438 K, respectively. It undergoes an isothermal expansion that triples the volume of the gas. Then, the gas undergoes an isobaric compression back to its original volume. Finally, the gas undergoes an isochoric increase in pressure, so that the final pressure, volume, and temperature are $p_0 V_0$ and 438 K, respectively. Find the total heat for this three-step process, and state whether it is absorbed by or given off by the gas.

A. $3640 J$ absorbed

B. -1820 J given off

C. 1570 J , absorbed

D. $-1110 J$, given off

Answer: C

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44. Suppose a monatomic ideal gas is contained within a vertical cylinder that is fitted with a movable piston. The piston is frictionless and has a negligible mass. The area of the piston is $3.14 \times 10^{-2} m^2$, and the pressure outside the cylinder is 1.01×10^5 Pa. Heat (2093 J) is removed from the gas. Through what distance does the piston drop?

A. $0.185 m$

B. $0.389 m$

C. $0.539 m$

D. $0.264 m$

Answer: D

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45. The efficiency of an automobile engine increases by 5.0%. For an input heat of 1300 J, how much more work does the engine produce?

A. 26 J

B. 65 J

C. 41 J

D. 88 J

Answer: B

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46. Engine 1 has an efficiency of 0.18 and requires 5500 J of input heat to perform a certain amount of work. Engine 2 has an efficiency of 0.26 and performs the same amount of work. How much input heat does the second engine require?

A. 7900J

B. 3800 J

C. 6700 J

D. 4400 J

Answer: B

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47. A Carnot engine has an efficiency of 0.40. The Kelvin temperature of its hot reservoir is quadrupled, and the Kelvin temperature of its cold reservoir is doubled. What is the efficiency that results from these changes?

A. 0.30

B. 0.60

C. 0.50

D. 0.70

Answer: D

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48. The hot reservoir for a Carnot engine has a temperature of 890 K, while the cold reservoir has a temperature of 670 K. The heat input for this engine is 4800 J. The 670 K reservoir also serves as the hot reservoir for a second Carnot engine. This second engine uses the rejected heat of the first engine as input and extracts additional work from it. The rejected heat from the second engine goes into a reservoir that has a temperature of 420 K. Find the total work delivered by the two engines.

A. $3500J$

B. $2500J$

C. $3000J$

D. $2000J$

Answer: B

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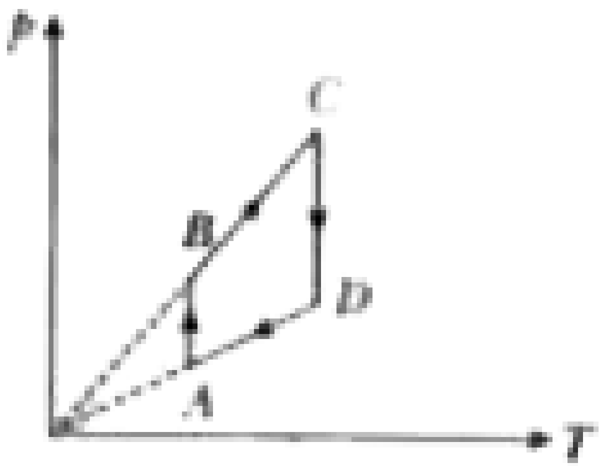
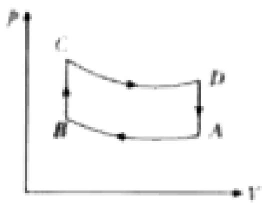
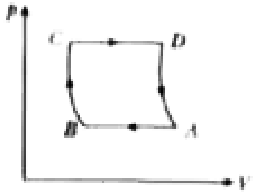
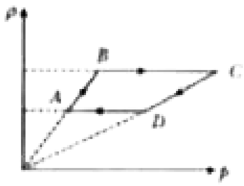
Practice Questions More Than One Correct Choice Type

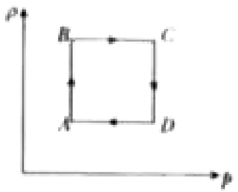
1. Pressure temperature (p-1) graph of n moles of an ideal gas is shown in the figure. Among the following four graphs, which are the corresponding pressure volume (p-V) and density pressure (p-p) graphs?



A. 

B. 

C. 

D. 

Answer: A::C

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2. A gas may expand either adiabatically or isothermally. A number of $p - V$ curves are drawn for the two processes over different ranges of pressure and volume, it will be found that

(i) Two adiabatic curves do not intersect

(ii) two isothermal curves do not intersect

(iii) an adiabatic curve and an isothermal curve may intersect.

(iv) the magnitude of the slope of an adiabatic curve is greater than the magnitude of the slope of an isothermal curve

A. two adiabatic curves do not intersect

B. two isothermal curves do not intersect

C. an adiabatic curve and an isothermal curve may intersect

D. the magnitude of the slope of an adiabatic curve is greater than the magnitude of the slope of an isothermal curve for the same values of pressure and volume

Answer: A::B::C

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3. Which of the following is true in case of isothermal changes?

A. $\Delta T = 0$

B. $\Delta U_{Int} = 0$

C. $\Delta Q = 0$

D. $\Delta U_{Int}) + \Delta W = 0$

Answer: A::B

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4. For an ideal gas,

A. the change in internal energy in a constant pressure process from temperature T_1 toT_2 is equal to $nC_v(T_2 - T_1)$, where $C_v$is the molar specific heat at constant volume and n, the number of moles of the gas.

B. the change in internal energy of the gas and the work done by the gas are equal in magnitude in an adiabatic process.

C. no heat is added or removed in an adiabatic process.

D. the internal energy does not change in an isothermal process.

Answer: A::B::C::D

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5. A system undergoes a cyclic process in which it absorbs Q_1 heat and gives out Q_2 heat. The efficiency of the process is η and work done is W. Select correct statement:

A. $W = Q_1 - Q_2$

B. $\eta = W / Q_1$

C. $\eta = Q_2 / Q_1$

D. $\eta = 1 - (Q_2 / Q_1)$

Answer: A::B::D

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6. A steel drill making 180 rpm is used to drill a hole in a block of steel. The mass of the steel block and the drill is 180 gm. If the entire mechanical work is used up in producing heat and the rate of raise in temperature of the block and the drill is 0.5 °C/s. Find

(a) the rate of working of the drill in watts, and

(b) the torque required to drive the drill. Specific heat of steel $= 0.1$ and $J = 4.2J/cal$. Use : $P = \tau\omega$

A. $P = 37.8W$

B. $p = 9W$

C. $\tau = 2N.m$

D. $\tau = 6.3n.m$

Answer: A::C

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7. An ideal gas is heated from termperature T_1 to T_2 under various conditions. The correct statements(s) is/are:-

A. $\Delta E = nC_v(T_2 - T_1)$ for isobaric, isochoric and adiabatic process.

B. Work is done at expense of internal energy in an adiabatic process and both have equal.

C. ΔE_{int} =0 for an isothermal process.

D. C_p =0 for an adiabatic process.

Answer: A::B::C::D

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8. The internal energy of a system remains constant when it undergoes

A. a cyclic process.

B. an isothermal process

C. an adiabatic process.

D. any process in which the heat given out by the system is equal to a work done on the system.

Answer: A::B::D

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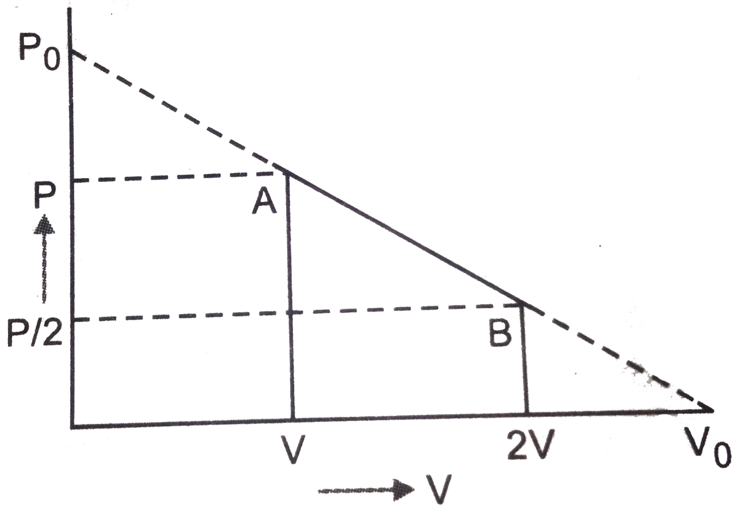
9. An ideal gas is taken from the state A (P, V) to the state B $(P/2, 2V)$ along a st. line path as shown in Fig. Select the correct statement from the following:



A. The work done by the gas in that would be done by it if the system were taken from A to B along the isotherm.

B. In the T-V diagram, the path AB becomes a part of parabola.

C. In the p-T diagram, the path AB becomes a part of hyperbola.

D. In going from A to B the temperature T of the gas first increases to a maximum value and then decreases.

Answer: A::B::D

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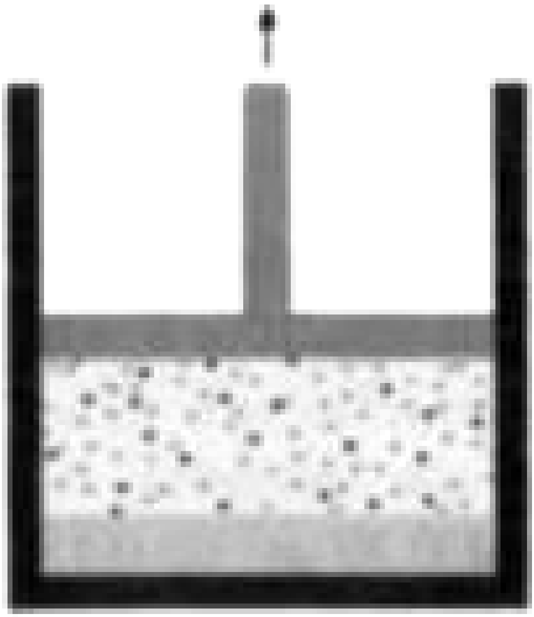
Practice Questions Linked Comprehension

1. 5.00 kg of liquid water is heated to $100.0^{\circ}C$ in a closed system At this temperature , the density of liquid water is 958 kg/m^3 . The pressure is maintained at atmospheric pressure of 1.01×10^5 Pa. A moveable piston of negligible weight rests on the surface of the water. The water is then converted to steam by adding an additional amount of heat to the system. When all of the water is converted, the final volume of the steam is $8.50 m^3$. The latent heat of vaporization of water is 2.26×10^6 J/kg.



How much work is done by this closed system during this isothermal process?

A. $8.37J$

B. $4.20 \times 10^3 J$

C. $1.21 \times 10^4 J$

D. $8.58 \times 10^5 J$

Answer: D

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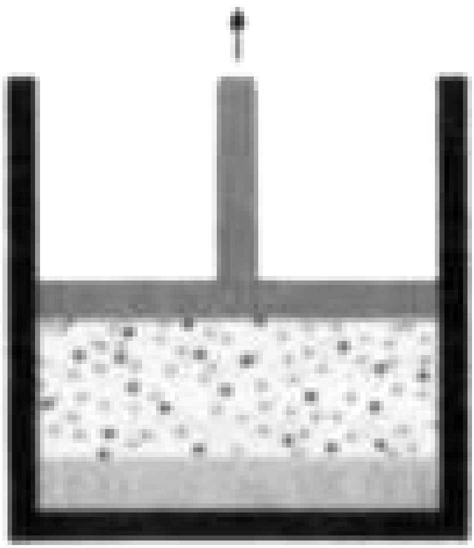
2. 5.00 kg of liquid water is heated to $100.0^{\circ}C$ in a closed system At this temperature , the density of liquid water is 958 kg/m^3 . The pressure is maintained at atmospheric pressure of 1.01×10^5 Pa. A moveable piston of negligible weight rests on the surface of the water. The water is then converted to steam by adding an additional amount of heat to the system. When all of the water is converted, the final volume of the steam is $8.50m^3$. The latent heat of vaporization of water is 2.26×10^6 J/kg.



How much heat is added to the system in the isothermal process of converting all of the water into steam?

A. 2.17×10^3J

B. $1.13 \times 10^7 J$

C. $1.70 \times 10^4 j$

D. $3.78 \times 106 J$

Answer: B

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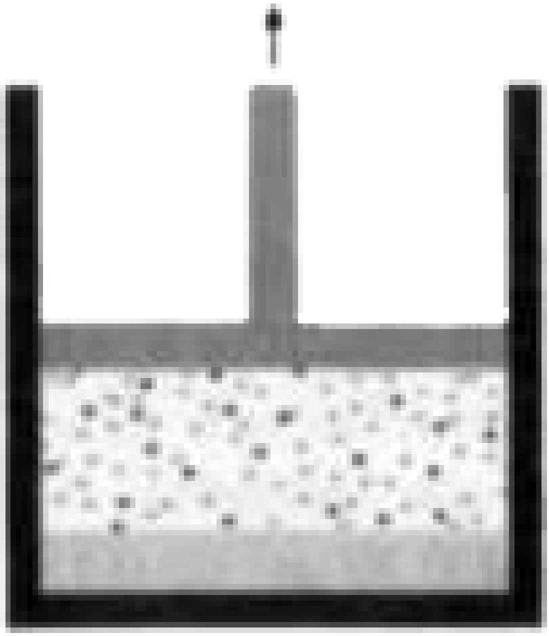
3. 5.00 kg of liquid water is heated to $100.\ 0^\circ C$ in a closed system At this temperature , the density of liquid water is 958 kg/m^3 . The pressure is maintained at atmospheric pressure of 1.01×10^5 Pa. A moveable piston of negligible weight rests on the surface of the water. The water is then converted to steam by adding an additional amount of heat to the system. When all of the water is converted, the final volume of the steam is $8.50 m^3$. The latent heat of vaporization of water is 2.26×10^6 J/kg.



What is the change in the internal energy during this isothermal process?

A. zero joules

B. $1.04 \times 10^{7} J$

C. $1.28 \times 10^{4} J$

D. $2.93 \times 10^{6} J$

Answer: B

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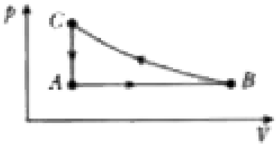
4. An ideal monatomic gas expands isobarically from state A to state B. It is then compressed isothermally from state B to state C and finally cooled at constant volume until it returns to its initial state A.



$V_A = 4 \times 10^{-3}\ m^3$	$V_B = 8 \times 10^{-3}\ m^3$
$P_A = P_B = 1 \times 10^{6}\ Pa$	$T_A = 600\ K$

What is the temperature of the gas when it is in state B?

A. 437 K

B. 927 K

C. 573 K

D. 1200 K

Answer: D

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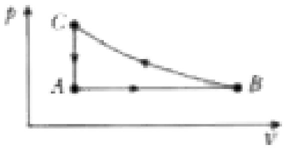
5. An ideal monatomic gas expands isobarically from state A to state B. It is then compressed isothermally from state B to state C and finally cooled at constant volume until it returns to its initial state A.



$V_A = 4 \times 10^{-3}\ m^3$	$V_B = 8 \times 10^{-3}\ m^3$
$P_A = P_B = 1 \times 10^6\ Pa$	$T_A = 600\ K$

How much work is done by the gas in expanding isobarically from A to B?

A. $1 \times 10^3 J$

B. $3 \times 10^3 J$

C. $2 \times 10^3 J$

D. $4 \times 10^3 J$

Answer: D

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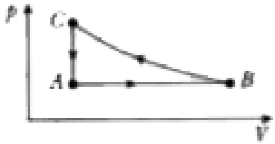
6. An ideal monatomic gas expands isobarically from state A to state B. It is then compressed isothermally from state B to state C and finally cooled at constant volume until it returns to its initial state A.



$V_A = 4 \times 10^{-3}\ m^3$	$V_B = 8 \times 10^{-3}\ m^3$
$P_A = P_B = 1 \times 10^6$ Pa	$T_A = 600$ K

How much work is done on the gas in going from B to C?

A. 2.5×10^6J

B. $4.5 \times 10^6 J$

C. $5.5 \times 10^6 J$

D. $6.5 \times 10^6 J$

Answer: C

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7. Two moles of an ideal gas have an initial kelvin temperature T_i and absolute pressure P_i the gas undergoes a reversible isothermal compression from an initial volume V_i to a final volume 0.5 V_i

which one of the following expressions represents the final pressure of the gas ?

A. $0.5P_i$

B. $2p_i$

C. $4P_i$

D. $p_i\,/\,31.7$

Answer: B

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8. Two moles of an ideal gas have an initial kelvin temperature T_i and absolute pressure P_i the gas undergoes a reversible isothermal compression from an initial volume V_i to a final volume 0.5 V_i

How much heat is exchanged with the environment? If heat is exchanged, is it absorbed or released?

A. p_iV_i(In a) , Released

B. P_iV_i(In 2) ,absorbed

C. $(0.5)P_iv_i$ released

D. $(0.5)P_iV_i$ absorbed

Answer: A

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9. Two moles of an ideal gas have an initial kelvin temperature T_i and absolute pressure P_i the gas undergoes a reversible isothermal compression from an initial volume V_i to a final volume 0.5 V_i

The ratio of the molar specific heat capacity at constant pressure to that at constant volume, γ,for diatomic hydrogen gas is 7/5. In an adiabatic compression, the gas, originally at atmospheric pressure, is compressed from an original volume of $0.30m^3$ to $0.15m^3$ What is the final pressure of the gas?

A. $2.0 \times 10^5 Pa$

B. $2.7 \times 10^5 Pa$

C. $3.0 \times 10^5 Pa$

D. $3.7 \times 10^5 Pa$

Answer: B

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10. Carnot engine is an ideal heat engine, which converts heat energy into mechanical energy. Efficiency of Carnot engine is given by $\eta = 1 - (T_2 / T_1)$, where T_1 is temperature of source and T_1, is temperature of sink. If Q_1 is the amount of heat absorbed/cycle from the source, Q_2 is the amount of heat rejected/cycle to the sink and W is the amount of useful work done/cycle, then

$$W = Q_1 - Q_2 \text{ and } \frac{Q_2}{Q_1} = \frac{T_2}{T_1}$$

A Carnot engine absorbs 6×10^5 cal. at 227°C. Heat rejected to the sink at 127°C is

A. 6×10^5cal

B. 4.8×10^5 cal

C. 4×10^5 cal

D. 5×10^5 cal

Answer: B

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11. Carnot engine is an ideal heat engine, which converts heat energy into mechanical energy. Efficiency of Carnot engine is given by $\eta = 1 - (T_2 / T_1)$, where T_1 is temperature of source and T_1, is temperature of sink. If Q_1 is the amount of heat absorbed/cycle from the source, Q_2 is the amount of heat rejected/cycle to the sink and W is the amount of useful work done/cycle, then

$$W = Q_1 - Q_2 \text{ and } \frac{Q_2}{Q_1} = \frac{T_2}{T_1}$$

Work done/cycle by the engine in the above question is. if source and sink temperature respectively 227 and 127 . heat absorbed by engine is given 6

.

A. 5.04×10^5 J

B. 5.04×10^5 cal

C. 4.8×10^5 cal

D. $4.8 \times 10^5 J$

Answer: A

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12. Carnot engine is an ideal heat engine, which converts heat energy into mechanical energy. Efficiency of Carnot engine is given by $\eta = 1 - (T_2 / T_1)$, where T_1 is temperature of source and T_1, is temperature of sink. If Q_1 is the amount of heat absorbed/cycle from the source, Q_2 is the amount of heat rejected/cycle to the sink and W is the amount of useful work done/cycle, then

$$W = Q_1 - Q_2 \text{ and } \frac{Q_2}{Q_1} = \frac{T_2}{T_1}$$

Efficiency of the engine in the above question is .if source and sink temperature respectively 227 and 127 .

A. 0.3

B. 0.1

C. 0.2

D. 0.8

Answer: C

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13. Carnot engine is an ideal heat engine, which converts heat energy into mechanical energy. Efficiency of Carnot engine is given by $\eta = 1 - (T_2/T_1)$, where T_1 is temperature of source and T_1, is temperature of sink. If Q_1 is the amount of heat absorbed/cycle from the source, Q_2 is the amount of heat rejected/cycle to the sink and W is the amount of useful work done/cycle, then

$$W = Q_1 - Q_2 \text{ and } \frac{Q_2}{Q_1} = \frac{T_2}{T_1}$$

At what temperature should the sink be maintained to increase the efficiency by 10%? if source and sink temperature respectively 227 and 127

A. 77 K

B. 300K

C. $300^{\circ} K$

D. $77^{\circ} C$

Answer: D

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14. first law of thermodynamics

$(\#\#MST_AG_J\exists_M A_P HY_V 01_C 21_E 03_{074} \_ Q01.png \text{ width=80 \%} > which$

-98 .6 ` K as the change in temperature ?

A. (III) (ii) (L)

B. (II) (ii) (J)

C. (II) (iii) (K)

D. (I) (i)(M)

Answer: B

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15. first law of thermodynamics

$(\#\#MST_AG_J\exists_M A_PHY_V01_C21_E03_{075}\_Q01.png\ \text{width=80}\,\%\ > which$

-93.15 K` as the change in temperature ?

A. (III)(iv)(L)

B. (I)(i)(K)

C. (II) (iii)(L)

D. (I) (ii)(L)

Answer: A

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Practice Questions Integer Type

1. An electric heater supplies heat to a system at a rate or 100 W. If the system performs work at a rate of 75 joules per second at what rate is the internal energy increasing ?

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2. An engine has an efficiency of 64% and producess 5500 J of work .Determine (a) the input heat .

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3. The work done by one mole of a monatomic ideal gas $(\gamma = 5/3)$ in expanding adiabatically is 825 J . The initial temperature and volume of the gas are 393 K and 0.100 m^3 obtain the final temperature of the gas .

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