PHYSICS

BOOKS - BITSAT GUIDE PHYSICS (HINGLISH)

LAWS OF THERMODYNAMICS

1

1. A boy weighing 50kg eats bananas. The energy constant of banan is 100cal , if this

energy is used to lift the body from ground, then the height through which his lifted is

A. 8.57m

B. 10.57M

C. 6.57M

D. 5.57M

Answer: a

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2. The heat energy

A. is a state variable

B. does not depend on the state of the system

C. is equal to internal energy of the system

D. None of the above

Answer:

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2

1. 1 kg mass of water, bolts at standard atmosphere pressure, turns completely into saturated vapour. Assume saturated vapour to be an ideal gas. Find the increment of internal energy of the system and internal work done. (Given, specific latent heat of avporisation of water=2250kJ/kg)

A. $3 \times 10^6 J$

B. $2.1 \times 10^6 J$

C. $3.2 \times 10^6 J$

D. $4.2 \times 10^6 J$

Answer: b

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2. In a thermodynamic process, pressure of a fixed mass of a gas is changed in such a manner that the gas release $20J$ of heat and $8J$ of work is done on the gas. If initial internal

energy of the gas was $30J$, what will be the final internal energy?

A. 2J

B. 42J

C. 18J

D. 58J

Answer:

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1. An ideal gas is heated at constant pressure and absorbs amount of heat Q. if the adiabatic exponent is γ. Then find the fraction of heat absorbed in raising the internal energy and perofrming the work is.

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

B. $1+\frac{1}{\gamma}$

C. $1-\frac{2}{\gamma}$

D. $1+\frac{2}{7}$

Answer: a

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2. A thermo-dynamical system is changed from state) ,(P_1, V_1) to (P_2, V_2) by two different process. The quantity which will remain same will be

A. ΔQ

B. ΔW

C. $\Delta Q + \Delta W$

D. $\Delta Q - \Delta W$

Answer:

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4

1. The latent gas is heated at constant pressure and absorbs amount of heat Q. if the adiabatic exponent is γ, then find the fraction of heat absorbed in raising the

A. 2408J

B. 2240J

C. 2072J

D. 1904J

Answer: c

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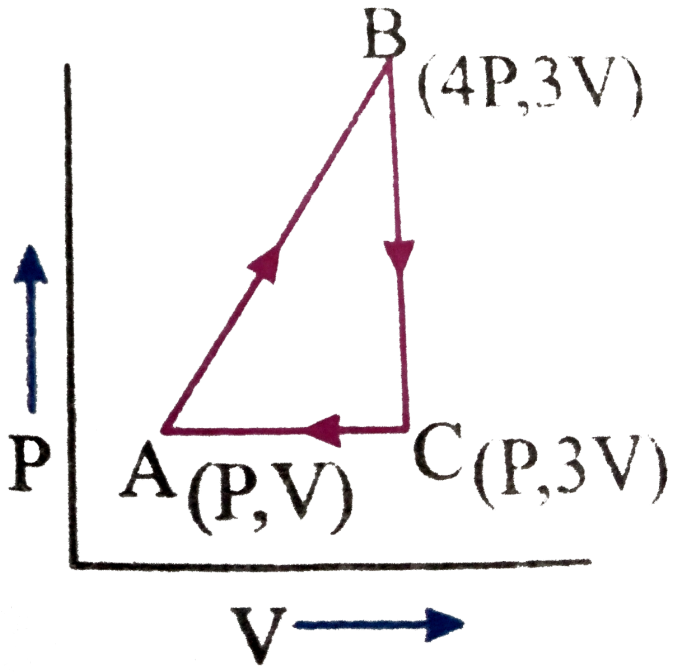
2. A sample of an ideal monoatomic gas is taken round the cycle ABCA as shown in the

figure the work done during the cycle is



A. $3\rho V$

B. zero

C. $9\rho v$

D. $6\rho V$

Answer:

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5

1. The molar heat capacity in a process of a diatomic gas if it does a work of $\frac{Q}{4}$ when a heat of Q is supplied to it is

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

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

C. $\frac{10}{3}R$

D. $\frac{6}{7}R$

Answer: c

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2. An ideal refrigerator has a freezer at a temperature of $-13^{\circ}C$. The coefficient of performance of the engine is 5. The temperature of the air (to which heat is rejected) will be

A. $325^\circ C$

B. 325K

C. $39^\circ C$

D. $320^\circ C$

Answer:

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6

1. Starting with the same initial conditions, an ideal gas expands from volume V_1 to V_2 in three different ways, the work done by the gas is W_1 if the process is purely isothermal, W_2 if purely isobaric and W_3 if purely adiabatic, then

A. $W_2 > W_1 > W_3$

B. $W_2 > W_3 > W_1$

C. $W_1 > W_2 > W_3$

D. $W_1 > W_3 > W_2$

Answer: a

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2. In the adiabatic compression the decrease in volume is associated with

A. increase in temperature and decrease in pressure

B. decrease in temperature and increase in pressure

C. decrease in temperature and decrease in pressure

D. increase in temperature and increase in pressure

Answer:

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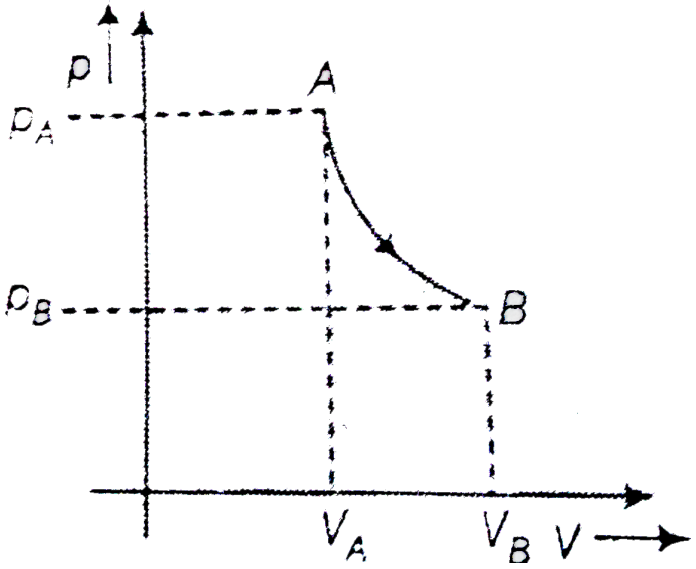
7

1. Calculates the work done (W_{AB}) by the gas, if 5 moles of an ideal gas is carried by a quasi state isothermal process at 500K to twice its volume.



A. 1500J

B. 14407J

C. 13380J

D. 14890J

Answer: b

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2. Which of the following is true in the case of an adiabatic process, where $\gamma = \frac{C_p}{C_v}$?

A. $p^{1-\gamma}T^{y} =$ constnat

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

C. $pT^{y} = \text{constant}$

D. $p^{\gamma}T$=constnat

Answer:

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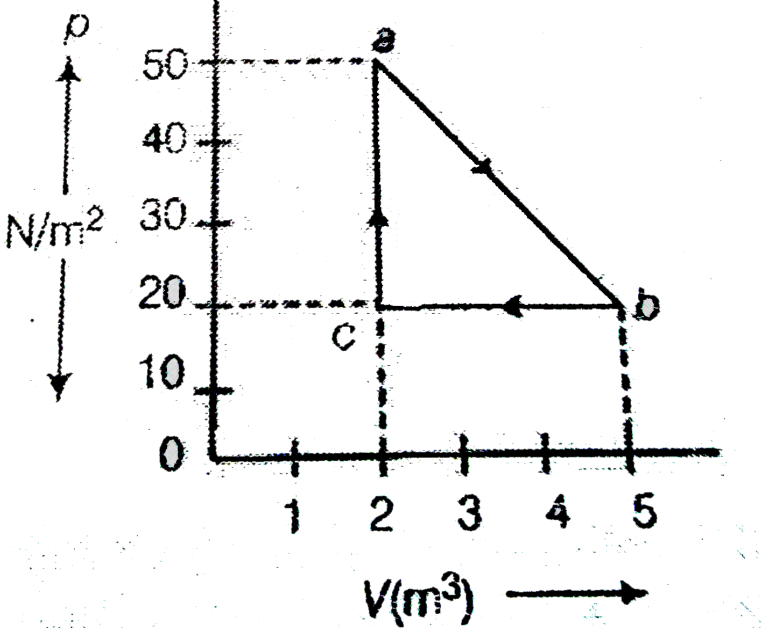
8

1. The work done for the cycle shown in given figure, will be



A. 45J

B. 54J

C. 22.5J

D. 32.5J

Answer: a

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2. Initially two gas samples 1 and 2 are at the same condition. The volume of the two are halved, one isothermally and the other adiabatically. What is the relation between the final pressures p_1 and p_2?

A. $p_1 = p_2$

B. $p_1 > p_2$

C. $p_2 > p_1$

D. Cannot be determined

Answer:

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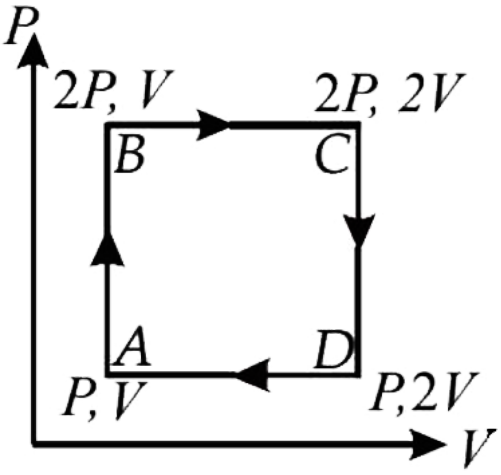
9

1. An ideal monoatomic gas is taken round the cycle ABCDA as shown in the P-V diagram. The

work done during the cycle is



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

B. ρV

C. $2\rho V$

D. $4\rho V$

Answer: d

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2. A cane is taken out from a refrigerator at $0^\circ\,\mathrm{C}$. The atmospheric temperature is $25^\circ\,\mathrm{C}$. If t1 is the time taken to heat from $0^\circ\,\mathrm{C}$ to $5^\circ\,\mathrm{C}$ and t_2 is the time taken from $10^\circ\,\mathrm{C}$ to $15^\circ\,\mathrm{C}$, then the wrong statements are

(1) $t_1 > t_2$

(2)$t_1 = t_2$

(3) There is no relation

(4)$t_1 < t_2$

A. $t_1 > t_2$

B. $t_1 < t_2$

C. $t_1 = t_2$

D. there is no relation

Answer:

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10

1. A balloon that is initially flat, is initiated by filling it from a tank of compressed air. The final volume of the balloon is $5m^3$. The barometer reads 95kPa. The work done in this process is

A. $475 \times 10^5 J$

B. $4.75 \times 10^7 J$

C. $4.75 \times 10^3 J$

D. $4.75 \times 10^5 J$

Answer: d

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11

1. What work will be done, when 3 moles of an ideal gas are compreseed to half the initial volume at a constant temperature of 300K?

A. $-5188J$

B. 5000J

C. 5188J

D. $-5000J$

Answer: a

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12

1. A gas is contained in a cyclinder and expands according to the relation ρV^{13} =constant. The initial pressure and initial volume of the gas are 30atm. And 30L

respectively. If the final pressure is 15atm, then calculate the work done on the face of piston by the pressure force of the gas.

A. $5 \times 10^4 J$

B. $4.36 \times 10^4 J$

C. $3 \times 10^6 J$

D. $4 \times 10^4 J$

Answer: b

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13

1. Show a vertical cylindrical vesse seperated in two parts by a frictionless piston free to move along the length of vessel. The length of the cylilender is 90 cm and the piston divides the cylinder in the ratio of 5:4. Each of the two parts of the vessel contains 0.1 mole of an ideal gas. The temoerature of the gas is 300K in each part. Calculate the mass of the piston. (figure)

A. 14kg

B. 12.7kg

C. 16kg

D. 15kg

Answer: b

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14

1. During an isothermal expansion of an ideal gas

A. Its internal energy decreases

B. Its internal energy does not change

C. the work done by the gas is equal to the quantity of heat absorbed by it.

D. both b and c are correct

Answer: d

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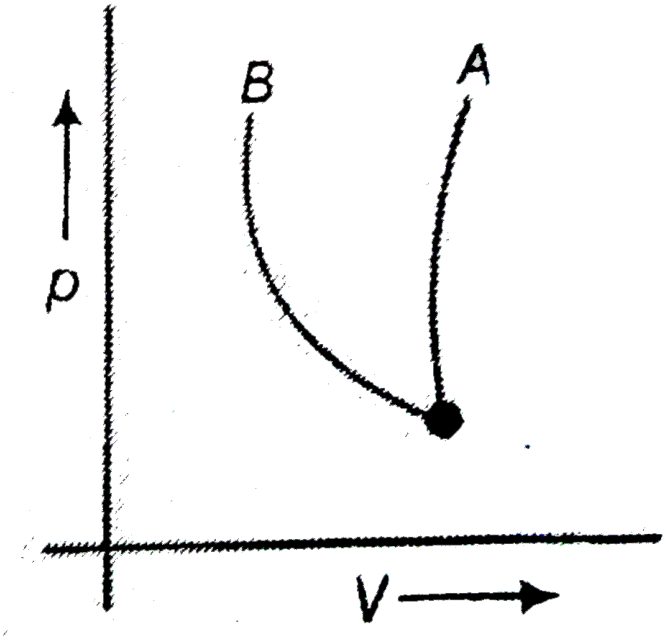
15

1. In the given graph, adiabatic and isothermal curves are shown. Then,



A. the curve A is isothermal

B. the curve B is isothermal

C. the curve A is adiabatic

D. the curve B is adiabatic

Answer: b,c

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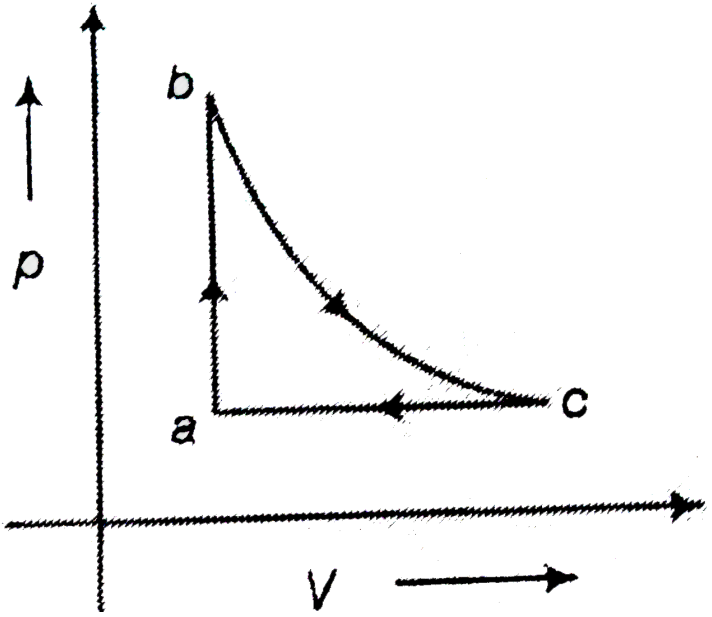
16

1. 0.2moles of an ideal gas, is taken around the cycle abc as shown in the figure. The path b-c is adiabatic process, a-b is isovolumic process and c-a is isobaric process. The temperature at

a and b are $T_A = 300K$ and $T_b = 500K$ and pressure at a is 1 atmospere. find the volume at c.

(Given, $\gamma = \frac{C_p}{C_v} = \frac{5}{3}, R = 8.205 \times 10^{-2} L$ /atm/mol-K)



A. 6.9L

B. 6.68L

C. 5.52L

D. 5.82L

Answer: b

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17

1. At $27^\circ C$ a motor car tyre has pressure of 2 atmosphere. Find the temperautre. If the tyre

suddenly bursts. (Given, $\gamma_{\text{air}} = 1.4$)

A. 24.1K

B. 250K

C. 246.1K

D. 248K

Answer: c

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18

1. In an adiabatic expansion, a gas does 25J of work while in an adiabatic compression 100J of work is dione on a gas. The chagne of internal energy in the two processes respectively are

A. 25J and -100J

B. $-25J$ and 100J

C. $25J$ and $-100J$

D. 25J and 100J

Answer: b

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19

1. The molar heat capacity of oxygen gas at STP is nearly $2.5R$. As the temperature is increased, it gradually increase and approaches $3.5R$. The most appropriate reason for this behaviour is that at high temperatures

A. oxygen does not behave as an ideal gas

B. oxygen molecules dissociate in atoms

C. the molecules collide more frequently

D. molecular vibrations gradually become effective.

Answer: a

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20

1. P-V diagram of a diatomic gas is a straight line passing through origin. The molar heat

capacity of the gas in the process will be

A. 4R

B. 3R

C. 4R/3

D. 2.5R

Answer: b

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21

1. An ideal gas is taken from the state A (pressure P, volume V) to the state B (pressure $p/2$, volume 2V) along a straight line path in the P-V diagram. Select the correct statement (s) from the following :

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

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

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

D. In going goind A to B, the temperature T of the gas first decreases to a miniumum value and then increase.

Answer: a

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22

1. What is specific heat of a gas is an adiabatic process?

A. zero

B. greater than zero

C. less than zero

D. inifnity

Answer: a

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23

1. Molar heat capacity is directly related to

A. temperature

B. heat energy

C. molecular structure

D. mass

Answer: c

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24

1. If at NTP, velocity of sound in a gas is 1150 m/s, then find out the rms velocity of gas molecules at NTP. (Given R=8.3J/mol/K, $C_P = 4.8$ cal/mol/k).

A. 1600m/s

B. 1532.19m/s

C. 160m/s

D. 16m/s

Answer: b

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25

1. What is the molar heat capacity for the process, when 10J of heat added to a monoatomic ideal gas in a process in which

the gas performs a work of 5J on its surrrounding?

A. 2R

B. 3R

C. 4R/3

D. 5R

Answer: b

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1. Calculate the values of $\gamma = C_p / C_v$ for a gaseous mixture consisting of $v_1 = 2.0$ moles of oxygen and $v_2 = 3.0$ mole of carbon dioxide. The gases are assumed to be ideal.

A. 2.33

B. 1.33

C. 0.33

D. 3.33

Answer: b

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27

1. Find the molar specific heat of mixture at constnat volume. It one mole of a monoatomic gas is mixed with three moles of a diatomic gas.

A. 3.33R

B. 225R

C. 115R

D. 6.72R

Answer:

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28

1. A gas, for which γ is $\frac{4}{3}$ is heated at constant pressure. The percentage of heat supplied used for external work is

A. 0.25

B. 0.5

C. 0.75

D. 0.8

Answer:

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29

1. One mole of a gas isobarcally heated by 40K receives an amount of heat 1.162KJ. What is the ratio of specific heats of the gas?

A. 1.7

B. 1.4

C. 1.3

D. 1.5

Answer:

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30

1. In a process PT=constant, if molar heat capacity of a gas is C=37.35 J/mol-K, then find the number of degrees of freedom of molecules in the gas.

A. n=10

B. n=5

C. n=6

D. n=7

Answer:

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31

1. In a adiabatic process pressure is increased by $2/3\,\%$ if $C_P/C_V = 3/2$. Then the volume decreases by about

A. $-\frac{4}{9}\,\%$

B. $\frac{2}{3}\,\%$

C. 4%

D. $\frac{9}{4}\%$

Answer:

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32

1. A monoatomic ideal gas is expanded adiabatically to n times of its initial volume. The ratio of final rate of collision of molecules

with unit area of container walls to the initial rate will be

A. $n^{-4/3}$

B. $n^{4/3}$

C. $n^{2/3}$

D. $n^{-5/3}$

Answer:

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1. In the case of solid, number of degrees of freedom is

A. 3

B. 5

C. 6

D. 7

Answer:

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34

1. A given quantity of a ideal gas is at pressure P and absolute temperature T. The isothermal bulk modulus of the gas is

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

B. ρ

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

D. 2ρ

Answer:

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36

1. when the temperature of a body increses from t to $t + \Delta t$,its moment of inertia increases form I to $I + \Delta I$. The coefficient of linear expanison of the body is $\propto$. The ratio $\frac{\Delta I}{I}$ is equal to

A. $\frac{\Delta t}{t}$

B. $\frac{2\Delta t}{t}$

C. $\alpha\Delta t$

D. $2\alpha\Delta t$

Answer:

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37

1. A Carnot engine, whose efficiency is 40%, takes in heat from a source maintained at a temperature of 500K. It is desired to have an

engine of efficiency 60%. Then, the intake temperature for the same exhaust (sink) temperature must be:

A. efficiency of Carnot engine cannot be made larger than 50%

B. 1200K

C. 750K

D. 600K

Answer:

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38

1. The temperature inside and outside a refrigerator are 273 K and 300 K respectively. Assuming that the refrigerator cycle is reversible. For every joule of work done heat delivered to the surrounding will be nearly :-

A. 10J

B. 20J

C. 30J

D. 50J

Answer:

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39

1. In a mechanical refrigerator, the low temperature coils are at a temperature of -23° C and the compressed gas in the

condenser has a temperature of $27^{\circ}C$. The theoretical coefficient of performance is :-

A. 0.7

B. 0.2

C. 0.0023

D. $2.5\ \%$

Answer:

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1. A Carnot engine work as refrigerator in between $0^\circ C$ and $27^\circ C$. How much energy is needed to freeze $10kg$ ice at $0^\circ C/$

A. 1.4

B. 1.8

C. 0.058

D. 2.5

Answer:

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