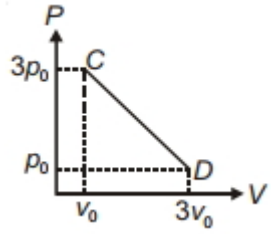
Jupiter Academy

Subjects : Physics **PRACTICE PAPER 08**

Total Marks : 180

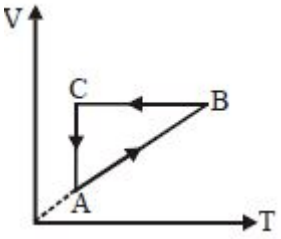
Physics - Section A (MCQ)

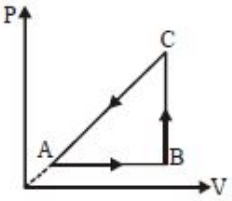
1. The process CD is shown in the diagram. As system is taken from C to D, what happens to the temperature of the system?

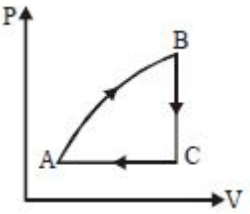


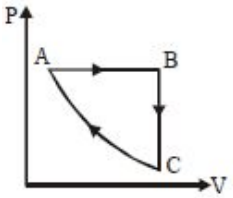
A) Temperature first decreases and then increases
B) Temperature first increases and then decreases
C) Temperature decreases continuously
D) Temperature increases continuously

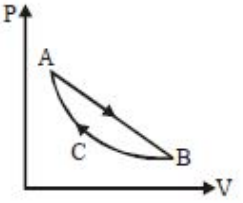
2. A cyclic process $ABCA$ is shown in the $V-T$ diagram. Process on the $P-V$ diagram is



A)


B)


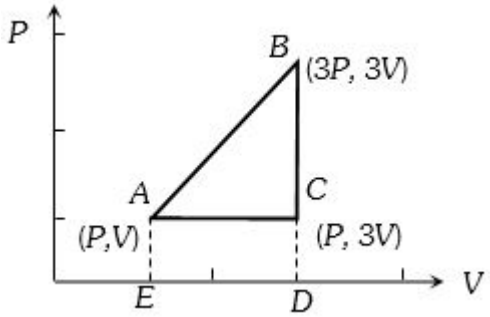
C)


D)


3. The process in which no heat enters or leaves the system is termed as

A) Isochoric **B)** Isobaric
C) Isothermal **D)** Adiabatic

4. An ideal gas is taken around $ABCA$ as shown in the above $P-V$ diagram. The work done during a cycle is



A) $2PV$ **B)** PV **C)** $1/2PV$ **D)** Zero

5. Neon gas of a given mass expands isothermally to double volume. What should be the further fractional decrease in pressure, so that the gas when adiabatically compressed from that state, reaches the original state?

A) $1-2^{-2/3}$ **B)** $1-3^{1/3}$
C) $2^{1/3}$ **D)** $3^{2/3}$

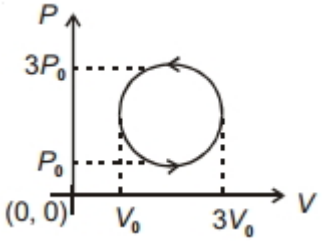
6. A diatomic gas undergoes a process represented by $PV^{1.3} =$ constant. Choose the incorrect statement

A) The gas expands by absorbing heat from the surroundings
B) The gas cools down during expansion
C) The work done by surroundings during expansion of the gas is negative
D) None of these

7. A gas undergoes a change at constant temperature. Which of the following quantities remain fixed?

A) Pressure
B) Entropy
C) Heat exchanged with the system
D) All the above may change

8. Work done in the cyclic process shown in figure is .....



A) $4P_0V_0$ B) $-4P_0V_0$
C) $-\frac{22}{7}P_0V_0$ D) $-13P_0V_0$

9. A Camot cycle consists of

A) Two stages B) Four stages
C) Six stages D) Eight stages

10. The volume of an ideal gas is 1 litre and its pressure is equal to $72cm$ of mercury column. The volume of gas is made $900\ cm^3$ by compressing it isothermally. The stress of the gas will be ..... cm (mercury)

A) 8 B) 7 C) 6 D) 4

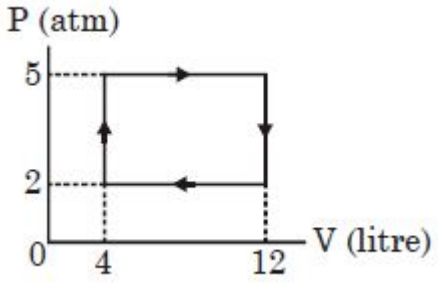
11. When heat energy of $1500\ Joules$, is supplied to a gas at constant pressure $2.1 \times 10^5\ N/m^2$, there was an increase in its volume equal to $2.5 \times 10^{-3}\ m^3$. The increase in internal energy of the gas in Joules is ..... J

A) 450 B) 525 C) 975 D) 2025

12. An air bubble of volume v_0 is released by a fish at a depth h in a lake. The bubble rises to the surface. Assume constant temperature and standard atmospheric pressure above the lake. The volume of the bubble just before touching the surface will be (density) of water is ρ

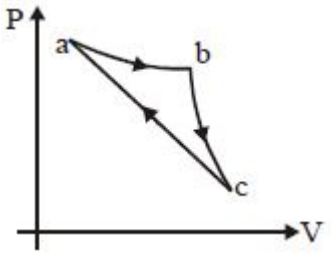
A) v_0
B) $v_0(\rho gh/p)$
C) $\frac{v_0}{\left(1+\frac{\rho gh}{p}\right)}$
D) $v_0\left(1+\frac{\rho gh}{p}\right)$

13. An ideal gas undergoes a cyclic process as shown in diagram. The net work done by the gas in the cycle is



A) $12\,litre-atm$ B) $24\,J$
C) $24\,litre-atm$ D) $-24\,J$

14. In the $P-V$ diagram shown, the gas does $5\ J$ of work in isothermal process ab and $4\ J$ in adiabatic process bc. .... J will be the change in internal energy of the gas in straight path c to a ?



A) 9 B) 1 C) 4 D) 5

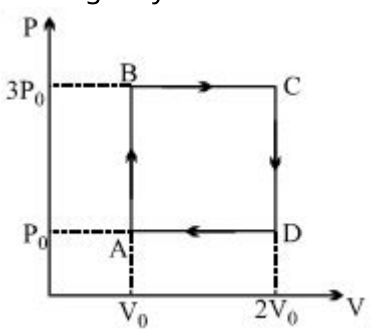
15. An iron rod of heat capacity C is heated to temperature $8T_0$. It is then put in a cylindrical vessel of adiabatic walls having two moles of air which can be treated as diatomic ideal gas at temperature T_0 and closed by a movable piston which is also adiabatic. The atmospheric pressure is P_0 . The cylinder with the piston combined have heat capacity $2C$. Find the equilibrium temperature . (Assume temperature of air to be uniform and equal to vessel at all times) .

A) $\left(\frac{8C+7R}{3C+7R}\right)T_0$ B) $\left(\frac{10C+7R}{C+7R}\right)T_0$
C) $\left(\frac{8C+7R}{C+7R}\right)T_0$ D) $\left(\frac{10C+7R}{3C+7R}\right)T_0$

16. Consider two containers A and B containing identical gases at the same pressure, volume and temperature. The gas in container A is compressed to half of its original volume isothermally while the gas in container B is compressed to half of its original value adiabatically. The ratio of final pressure of gas in B to that of gas in A is

A) $2^{\gamma-1}$ B) $\left(\frac{1}{2}\right)^{\gamma-1}$
C) $\left(\frac{1}{1-\gamma}\right)^2$ D) $\left(\frac{1}{\gamma-1}\right)^2$

17. A ideal monoatomic gas is carried around the cycle $ABCDA$ as shown in the fig. The efficiency of the gas cycle is



A) $\frac{4}{21}$ B) $\frac{2}{21}$
C) $\frac{4}{31}$ D) $\frac{2}{31}$

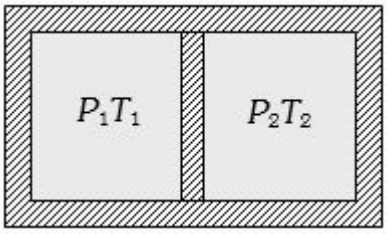
18. If heat is added at constant volume, $6300\ J$ of heat are required to raise the temperature of an ideal gas by $150\ K$. If instead, heat is added at constant pressure, 8800 joules are required for the same temperature change. When the temperature of the gas changes by $300\ K$, the internal energy of the gas changes by ..... J

A) 5000 **B)** 12600
C) 17600 **D)** 22600

19. Work done by air when it expands from $50\ litres$ to $150\ litres$ at a constant pressure of 2 atmosphere is

A) 2×10^4 joules
B) 2×100 joules
C) $2 \times 10^5 \times 100$ joules
D) $2 \times 10^{-5} \times 100$ joules

20. Following figure shows on adiabatic cylindrical container of volume V_0 divided by an adiabatic smooth piston (area of cross-section = A) in two equal parts. An ideal gas $(C_P/C_V = \gamma)$ is at pressure P_1 and temperature T_1 in left part and gas at pressure P_2 and temperature T_2 in right part. The piston is slowly displaced and released at a position where it can stay in equilibrium. The final pressure of the two parts will be (Suppose x = displacement of the piston)



A) P_2 **B)** P_1
C) $\frac{P_1\left(\frac{V_0}{2}\right)^\gamma}{\left(\frac{V_0}{2}+Ax\right)^\gamma}$ **D)** $\frac{P_2\left(\frac{V_0}{2}\right)^\gamma}{\left(\frac{V_0}{2}+Ax\right)^\gamma}$

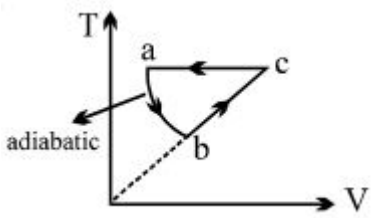
21. If a Carnot's engine functions at source temperature 127^oC and at sink temperature 87^oC, what is its efficiency ..... %

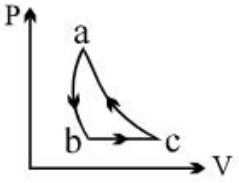
A) 50 **B)** 25 **C)** 40 **D)** 10

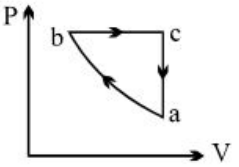
22. A gas undergoes a change of state during which $100J$ of heat is supplied to it and it does $20J$ of work. The system is brought back to its original state through a process during which $20J$ of heat is released by the gas. The work done by the gas in the second process is ..... J

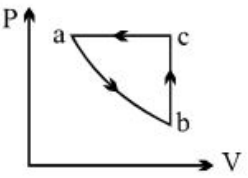
A) 60 **B)** 40 **C)** 80 **D)** 20

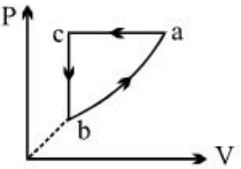
23. PV curve for the process whose VT curve is



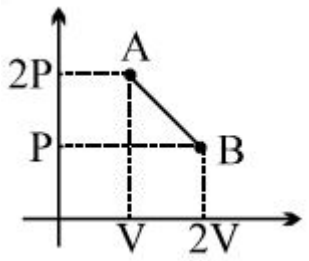
A)


B)


C)


D)


24. One mole of a gas expands obeying the relation as shown in the P/V diagram. The maximum temperature in this process is equal to



A) $\frac{P_0V_0}{R}$ **B)** $\frac{3P_0V_0}{R}$
C) $\frac{9P_0V_0}{8R}$ **D)** None of these

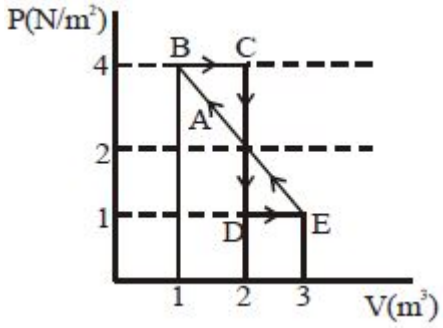
25. Avessel with open mouth contains air at 60^oC. When the vessel is heated upto temperature T, one fourth of the air goes out. The value of T is ..... ^oC

A) 80 **B)** 171 **C)** 333 **D)** 444

26. Monoatomic, diatomic and triatomic gases whose initial volume and pressure are same, are compressed till their volume becomes half the initial volume.

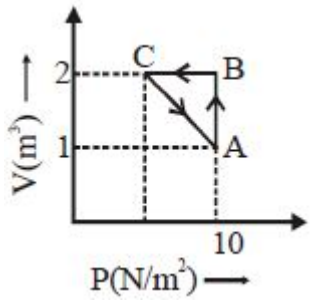
A) If the compression is adiabatic then monoatomic gas will have maximum final pressure.
B) If the compression is adiabatic then triatomic gas will have maximum final pressure.
C) If the compression is adiabatic then their final pressure will be same.
D) If the compression is isothermal then their final pressure will be different.

27. One mole of a monoatomic gas is carried along process $ABCDEA$ as shown in diagram. Find the net work done by gas ..... J



A) 1.5 **B)** 1 **C)** 0.5 **D)** 0

28. An ideal gas is taken through the cycle $A \to B \to C \to A$, as shown in the figure. What is the change in internal energy ..... J.

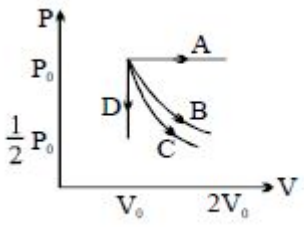


A) 0 **B)** -10 **C)** -15 **D)** -20

29. An ideal heat engine exhausting heat at $77\,^oC$. To have a 30% efficiency. It must take heat at..... ^oC

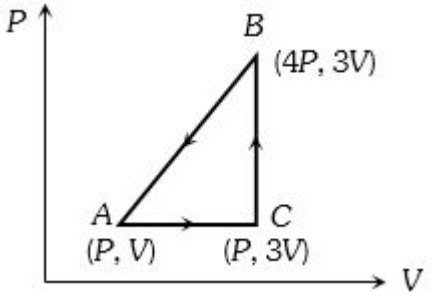
A) 127 **B)** 227 **C)** 327 **D)** 673

30. The PV diagram shows four different possible reversible processes performed on a monatomic ideal gas. Process A is isobaric (constant pressure). Process B is isothermal (constant temperature). Process C is adiabatic. Process D is isochoric (constant volume). For which process (es) does the temperature of the gas decrease?



A) Process A only
B) Process C only
C) Only Processes C and D
D) Only Processes B, C and D

31. A sample of ideal monoatomic gas is taken round the cycle $ABCA$ as shown in the figure. The work done during the cycle is



A) Zero **B)** $3PV$ **C)** $6PV$ **D)** $9PV$

32. A mono atomic gas is supplied the heat Q very slowly keeping the pressure constant. The work done by the gas will be

A) $\frac{2}{3}Q$ **B)** $\frac{3}{5}Q$ **C)** $\frac{2}{5}Q$ **D)** $\frac{1}{5}Q$

33. A polyatomic gas $\left(\gamma = \frac{4}{3}\right)$ is compressed to $\frac{1}{8}$ of its volume adiabatically. If its initial pressure is P_o, its new pressure will be

A) $8P_o$ **B)** $16P_0$
C) $6P_o$ **D)** $2P_o$

34. Compressed air in the tube of a wheel of a cycle at normal temperature suddenly starts coming out from a puncture. The air inside

A) Starts becoming hotter
B) Remains at the same temperature
C) Starts becoming cooler
D) May become hotter or cooler depending upon the amount of water vapour present

35. The adiabatic elasticity of hydrogen gas $(\gamma = 1.4)$ at NTP is

A) $1 \times 10^5\ N/m^2$ **B)** $1 \times 10^{-8}\ N/m^2$
C) $1.4\ N/m^2$ **D)** $1.4 \times 10^5 N/m^2$

36. 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) $\Delta Q - \Delta W$

37. The latent heat of vaporisation of water is $2240\ J/gm$. If the work done in the process of expansion of $1\ g$ is $168\ J$, then increase in internal energy is ..... J

A) 2408 **B)** 2240
C) 2072 **D)** 1904

38. A system performs work ΔW when an amount of heat isΔQ added to the system, the corresponding change in the internal energy is ΔU. A unique function of the initial and final states (irrespective of the mode of change) is

A) ΔQ
B) ΔW
C) ΔU and ΔQ
D) ΔU

39. If $R =$ universal gas constant, the amount of heat needed to raise the temperature of 2 mole of an ideal monoatomic gas from $273K$ to $373K$ when no work is done ..... R

A) 100 **B)** 150 **C)** 300 **D)** 500

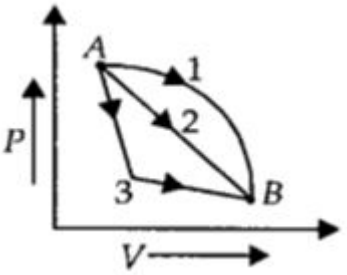
40. First law of thermnodynamics is given by

A) $dQ = dU + PdV$
B) $dQ = dU \times PdV$
C) $dQ = (dU + dV)\, P$
D) $dQ = PdU + dV$

41. $Assertion$: Reversible systems are difficult to find in real world.
$Reason$: Most processes are dissipative in nature.

A) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
B) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
C) If the Assertion is correct but Reason is incorrect.
D) If both the Assertion and Reason are incorrect.

42. An ideal gas goes from state A to state B via three different processes as indicated in the $P - V$ diagram. If Q_1, Q_2, Q_3 indicate the heat absorbed by the gas along the three processes and $\Delta U_1, \Delta U_2, \Delta U_3$
indicate the change in internal energy along the three processes respectively, then



A) $Q_1 < Q_2 < Q_3$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$
B) $Q_1 < Q_2 = Q_3$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$
C) $Q_1 = Q_2 > Q_3$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$
D) $Q_1 > Q_2 > Q_3$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$

43. An engine has an efficiency of $1/6$. When the temperature of sink is reduced by 62^oC, its efficiency is doubled. Temperatures of the source is ..... ^oC

A) 80 **B)** 95 **C)** 90 **D)** 99

44. The temperature inside a refrigerator is $t_2\,^oC$ and the room temperature is $t_1\,^oC$. The amount of heat delivered to the room for each joule of electrical energy consumed ideally will be

A) $\frac{t_2+273}{t_1-t_2}$
B) $\frac{t_1+t_2}{t_2+273}$
C) $\frac{t_1}{t_1-t_2}$
D) $\frac{t_1+273}{t_1-t_2}$

45. The efficiency of carnot engine is 50% and temperature of sink is $500\ K$. If temperature of source is kept constant and its efficiency raised to 60%, then the required temperature of the sink will be

A) 100 **B)** 400 **C)** 600 **D)** 500