DPP – 1

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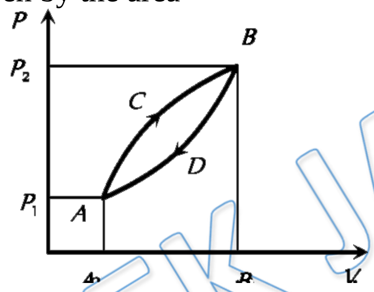
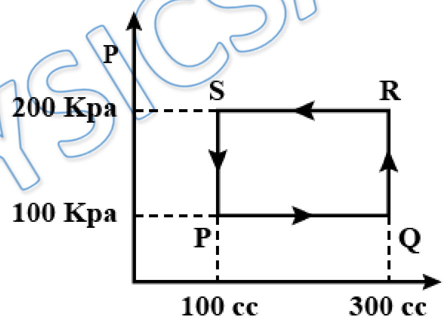
Q 1. A thermodynamic system is taken from state A to B along ACB and is brought back to A along BDA as shown in the PV diagram. The net work done by system during the complete cycle is given by the area



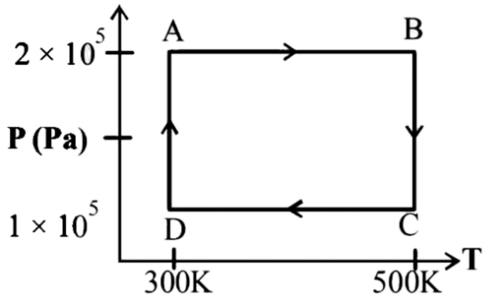
(a) $P_1ABCP_2P_1$
(b) $ACBB'A'A$
(c) $ACBDA$
(d) $ADBB'A'A$

Q 2. A thermodynamic system is taken through the cycle PQRSP process. The net work done by the system is



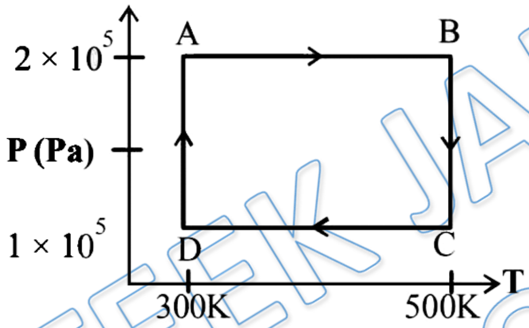
(a) 20 J
(b) −20 J
(c) 400 J
(d) −374 J

Q 3. Two moles of helium gas are taken over the cycle ABCDA, as shown in the P-T diagram. The work done on the gas in taking it from D to A is:



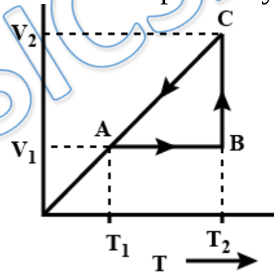
(a) $+414R$ (b) $-690R$
(c) $+690R$ (d) $-414R$

Q 4. Two moles of helium gas are taken over the cycle ABCDA, as shown in the P-T diagram. Assume the gas to be ideal the magnitude of work done on the gas in taking it form A to B is:



(a) $200R$ (b) $300R$
(c) $400R$ (d) $500R$

Q 5. A cyclic process for 1 mole of an ideal gas is shown in figure in the V-T, diagram. The work done by gas in AB, BC and CA respectively



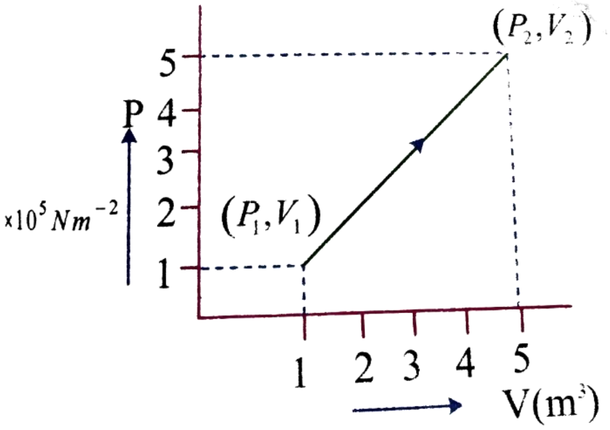
(a) $0,\ RT_2 \ln\left(\frac{V_1}{V_2}\right),\ R(T_1 - T_2)$

(b) $R(T_1 - T_2),\ 0,\ RT_1 \ln\left(\frac{V_1}{V_2}\right)$

(c) $0,\ RT_2 \ln\left(\frac{V_2}{V_1}\right),\ R(T_1 - T_2)$

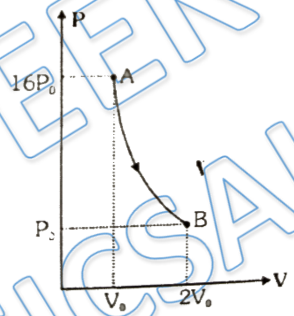
(d) $0,\ RT_2 \ln\left(\frac{V_2}{V_1}\right),\ R(T_2 - T_1)$

Q 6. A system changes from the state (P_1, V_1) to (P_2, V_2) as shown in the diagram. The work done by the system is



(a) 12×10^4J
(b) 12×10^8J
(c) 12×10^5J
(d) 6×10^4J

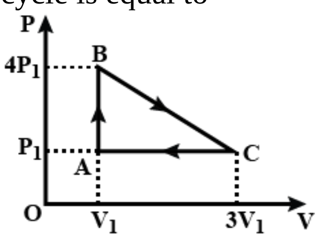
Q 7. Figure demonstrates a polytropic process (i.e. PV^n = constant) for an ideal gas. The work done by the gas be in the process AB is:



(a) $\frac{15}{2}P_oV_o$
(b) $\frac{14}{3}P_oV_o$
(c) $8P_oV_o$
(d) Insufficient information

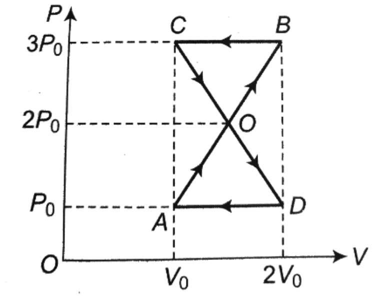
Q 8. The work done in an isochoric process is
(a) $zero$ (b) $+ve$
(c) $-ve$ (d) Any of these

Q 9. An ideal gas is taken around the cycle ABCA shown in P-V diagram. The net work done by the gas during the cycle is equal to



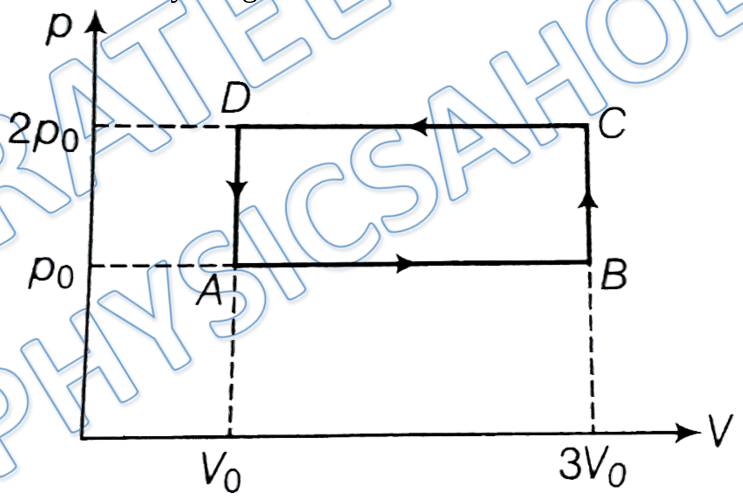
(a) $12P_1V_1$
(b) $6P_1V_1$
(c) $3P_1V_1$
(d) P_1V_1

Q 10. A thermodynamic system undergoes cyclic process ABCDA as shown in figure. The work done by the system is



(a) P_oV_o
(b) $2P_oV_o$
(c) $\frac{3P_oV_o}{2}$
(d) zero

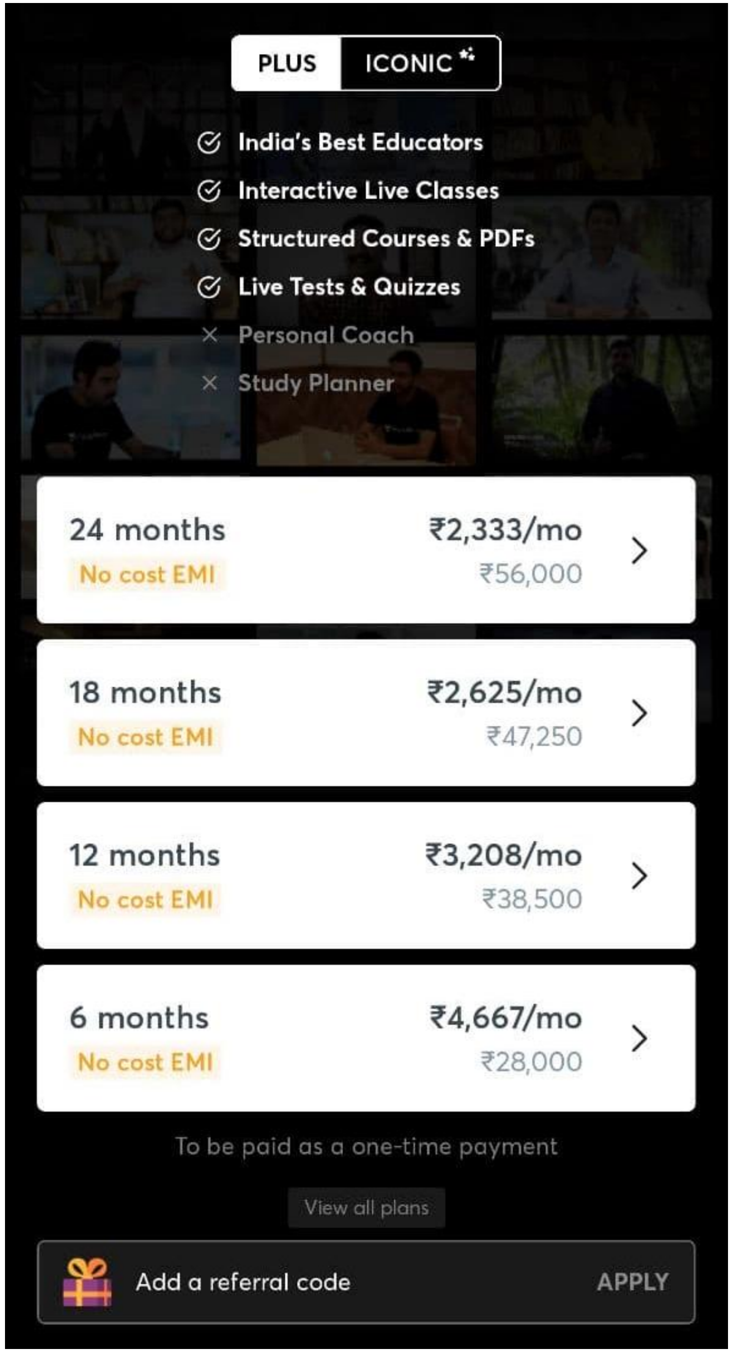
Q 11. An ideal gas undergoes cyclic process ABCDA as shown in given P-V diagram. The amount of work done by the gas is



(a) $6P_oV_o$
(b) $-2P_oV_o$
(c) $+2P_oV_o$
(d) $+4P_oV_o$

Answer Key

Q.1 c	**Q.2 b**	**Q.3 a**	**Q.4 c**	**Q.5 c**
Q.6 c	**Q.7 b**	**Q.8 a**	**Q.9 c**	**Q.10 d**
Q.11 b				



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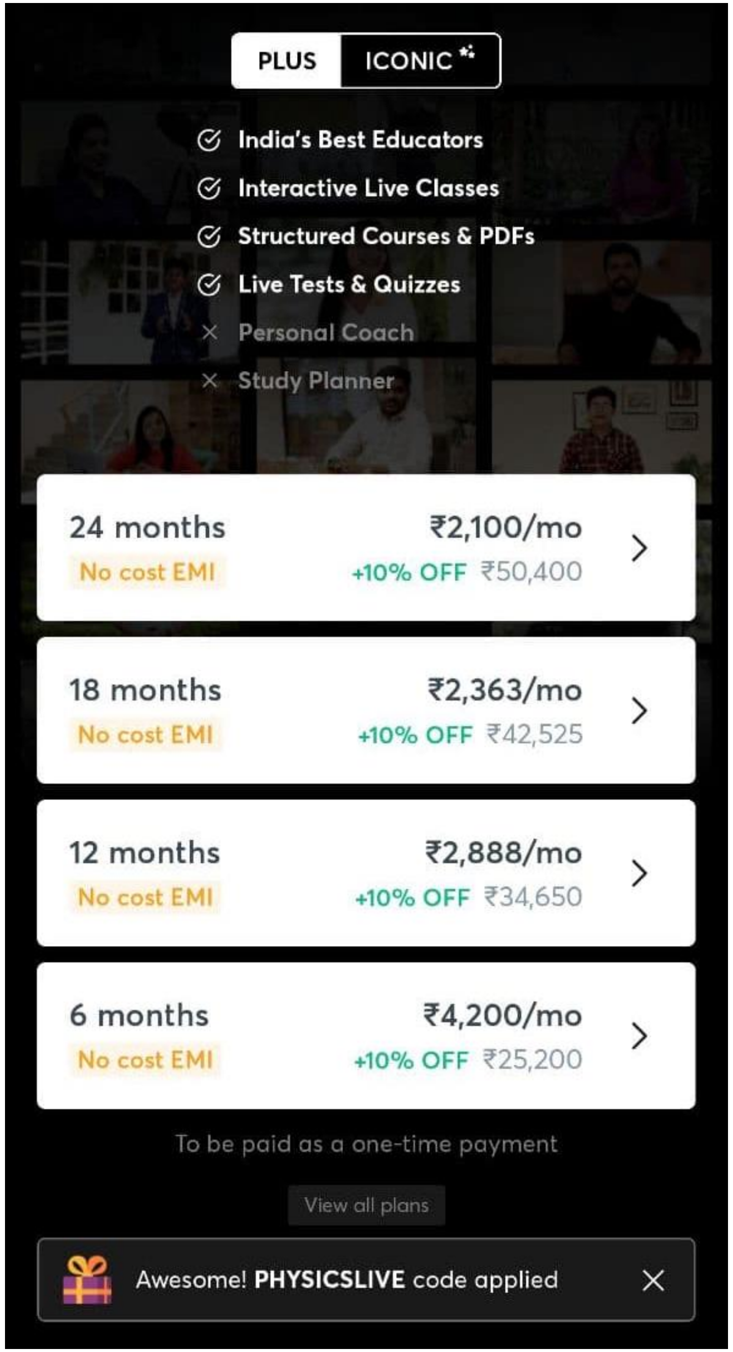


NEET & JEE Main
Physics DPP- Solution

DPP- 1 Thermodynamics- Work Done by Gas in Different Processes

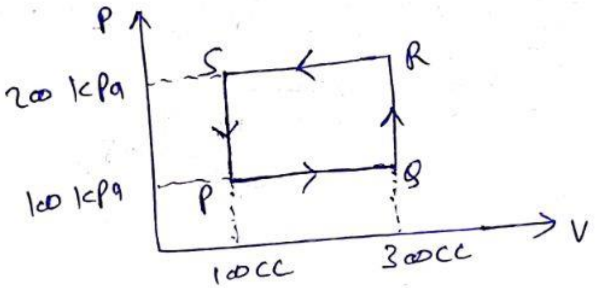
By Physicsaholics Team

Solution 1:

The work done in cyclic process is equal to the area enclosed by the PV diagram

Ans. c

Solution 2:



Here work done by the system = −ve of Area under P-V curve.

And work done in P→Q

$W_{PQ} = P\Delta V = (100\times10^3)(300-100)\times(10^{-2})^3$

$= 2\times10^4\times10^3\times10^{-6}$

$W_{PQ} = 20\ J.$

work done in Process Q→R & S→P

$W_{QR} = W_{SP} = 0$

(isochoric process)

$\Delta V = 0 \quad (\because V = \text{constant})$

work done in R→S

$W_{RS} = P\Delta V = 200\times10^3(100-300)\times(10^{-2})^3$

$W_{RS} = -200\times10^3\times200\times10^{-6}$

$= -4\times10^4\times10^3\times10^{-6}$

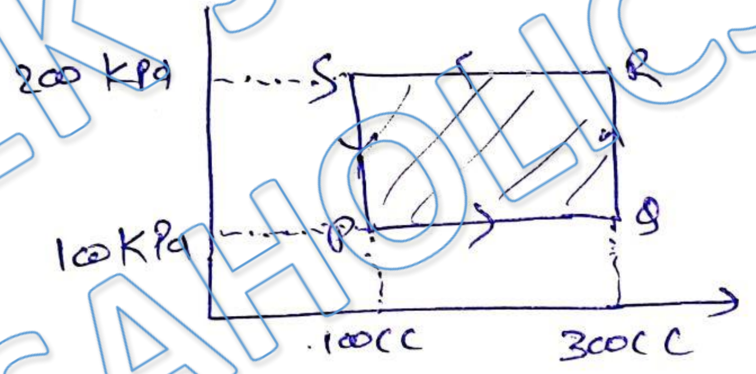
$W_{RS} = -40\ J.$

$W = W_{PQ} + W_{QR} + W_{RS} + W_{SP} = -20\ J.$

OR

work done by the system (W)

= Area of shaded portion on PV graph



$W = -(300-100)\times(10^{-2})^3\times(200-100)\times10^3$

$= -200\times10^{-6}\times100\times10^3$

$= -2\times10^4\times10^3\times10^{-6}$

$\boxed{W = -20\ J.}$

Ans. b

Solution 3:

in given P-T diagram

D-A Process is isothermal

$$\therefore \quad W = nRT \ln\left(\frac{V_2}{V_1}\right)$$

$$V = \frac{nRT}{P}$$

$$W = nRT \ln\left(\frac{\frac{nRT}{P_2}}{\frac{nRT}{P_1}}\right) = nRT \ln\left(\frac{P_1}{P_2}\right)$$

$$W = (2 \times R \times 300) \ln\left(\frac{10^5}{2 \times 10^5}\right) = 600R \ln\left(\frac{1}{2}\right)$$

$$W = 600R \ln 2^{-1} = -600R(\ln 2)$$

$$W = -414R$$ [$\because$ W = −ve mean work is done on gas]

Ans. a

$\therefore$ work done on gas = 414 R Joule

Solution 4:

A → B is isobaric process

$$\therefore \omega = P\Delta V = P(V_B - V_A)$$

$$\omega = P\left(\frac{nRT_B}{P} - \frac{nRT_A}{P}\right)$$

$$\omega = nR(T_B - T_A)$$

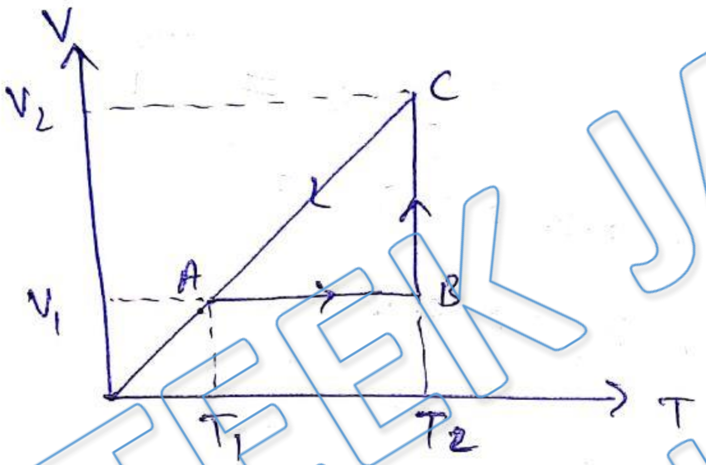
$$\omega = 2 \times R \times (500 - 300)$$

$$\omega = 400 \times R$$

$$\boxed{\omega = 400R \text{ Joule}}$$

Ans. c

Solution 5:



AB – Process is isochoric

$\therefore W_{AB} = P\Delta V = 0$

$$\boxed{W_{AB} = 0}$$

BC – Process is isothermal

$\therefore W_{BC} = nRT \ln\left(\frac{V_2}{V_1}\right)$

$$\boxed{W_{BC} = RT_2 \ln\left(\frac{V_2}{V_1}\right)}$$

CA – Process is isobaric

$\therefore W_{CA} = -P\Delta V$

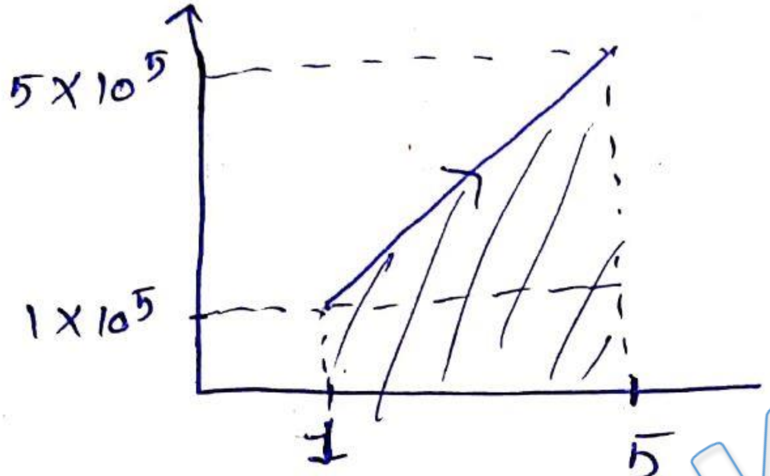
$= -R\Delta T$

$$\boxed{W_{CA} = R(T_1 - T_2)}$$

[-ve sign shows compression]

Ans. c

Solution 6:



W = Area under P-V graph.

$= \frac{1}{2}(5-1)\times(5-1)\times 10^5 + (5-1)\times(1-0)\times 10^5$

$= \frac{1}{2}\times 4\times 4\times 10^5 + 4\times 1\times 10^5$

$= 8\times 10^5 + 4\times 10^5$

$W = 12\times 10^5$ J.

Ans. c

Solution 7:

as given for Polytropic process: PV^n = constant

$$(PV^n)_A = (PV^n)_B$$

$$16P_0(V_0)^n = P_0(2V_0)^n$$

$$16V_0^n = 2^n V_0^n \Rightarrow 16 = 2^n \Rightarrow \boxed{n = 4}$$

& work done in Polytropic process

$$W = \frac{P_1V_1 - P_2V_2}{n-1}$$

$$W = \frac{16P_0 \times V_0 - P_0 \times 2V_0}{4-1} = \frac{16P_0V_0 - 2P_0V_0}{4-1}$$

$$\boxed{W = \frac{14P_0V_0}{3}}$$

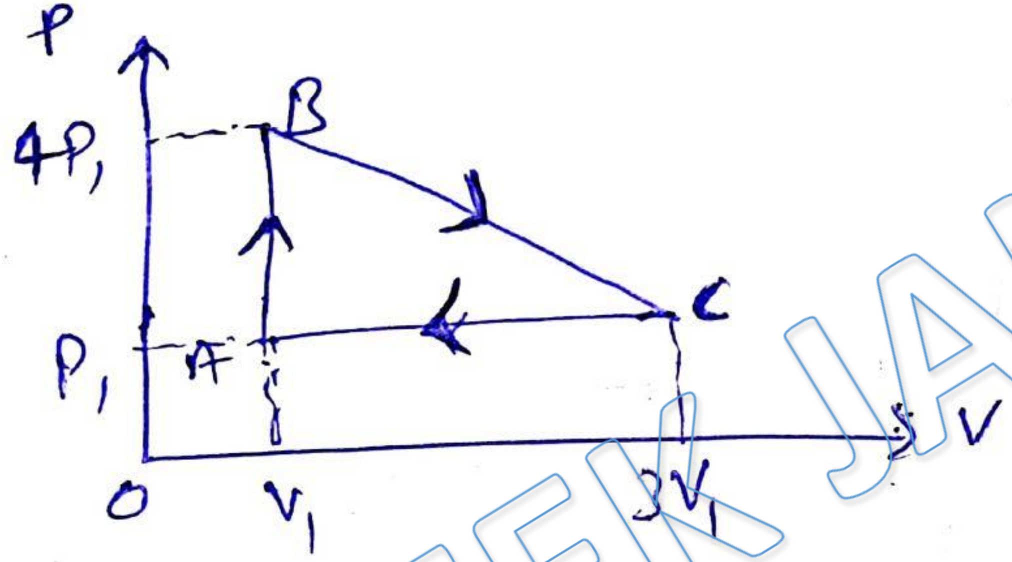
Ans. b

Solution 8:

An isochoric process is one in which the volume is held constant, meaning that the work done by the system will be zero.

Ans. a

Solution 9:



$$W = \frac{1}{2} \times (3V_1 - V_1) \times (4P_1 - P_1)$$

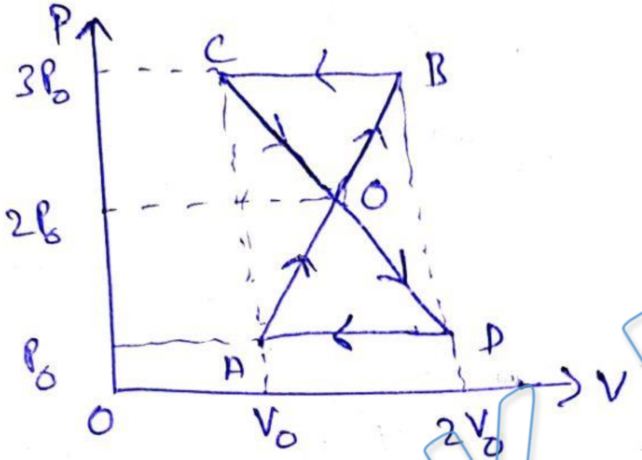
$$= \frac{1}{2} \times 2V_1 \times 3P_1$$

$$= 3P_1V_1$$

$$\boxed{W = 3P_1V_1}$$

Ans. c

Solution 10:



work done by system

$$W_{AODA} = +\left(\frac{1}{2}\times(2V_0 - V_0)(2P_0 - P_0)\right)$$

$$= +\frac{P_0V_0}{2}$$

$$W_{OBCO} = -\left(\frac{1}{2}\times(2V_0 - V_0)\times(3P_0 - 2P_0)\right)$$

$$W_{OBCO} = -\frac{1}{2}\times V_0\times P_0$$

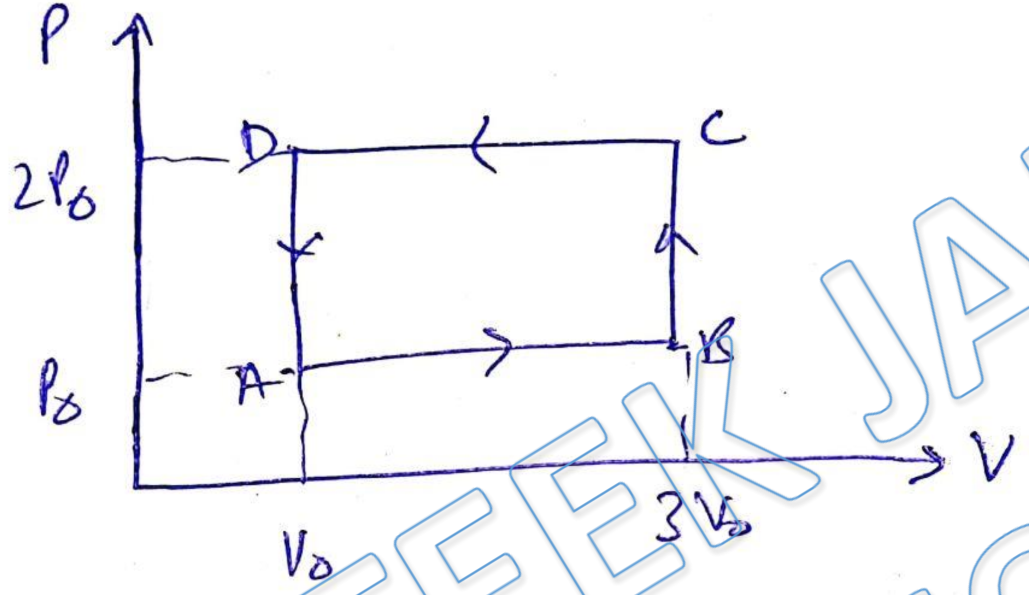
$$W_{OBCO} = -\frac{P_0V_0}{2}$$

$$W = W_{AODA} + W_{OBCO}$$

$$\boxed{W = 0}$$

Ans. d

Solution 11:



work done by gas

$$w = -\left((3V_0 - V_0) \times (2P_0 - P_0)\right)$$

$$w = -(2V_0 \times P_0)$$

$$\boxed{w = -2P_0V_0}$$

Ans. b

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