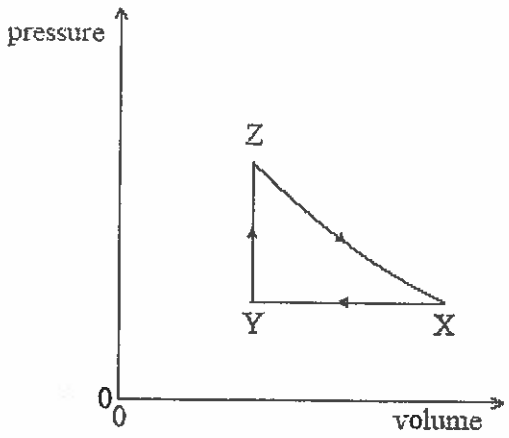
More Practice Option B2

1. The diagram shows the pressure volume relationship for a fixed mass of an ideal gas that undergoes a cycle XYZ.



In which part(s) of the cycle is external work done **on** the gas?

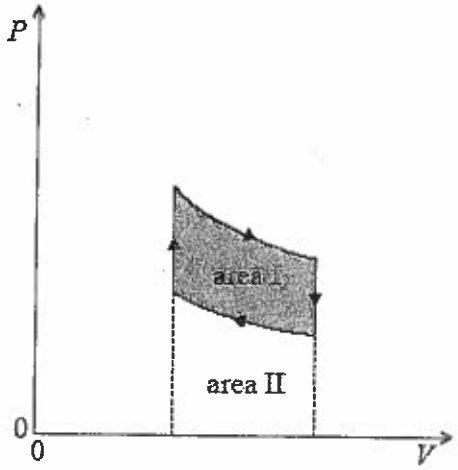
A. Y → Z only

B. Y → Z and Z → X only

C. X → Y and Z → X only

D. X → Y only

2. The diagram shows the pressure–volume (PV) relationship for a gas.



Which of the following area(s) is/are equal to the work done by the gas as it expands?

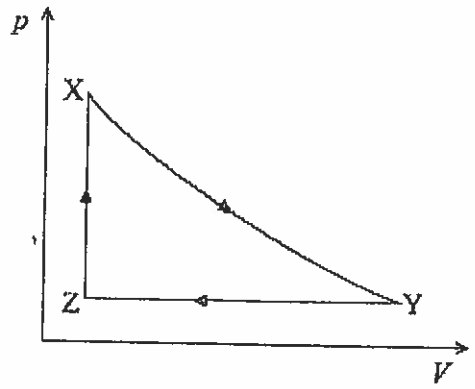
A. area I

B. area II

C. area I + area II

D. area I – area II

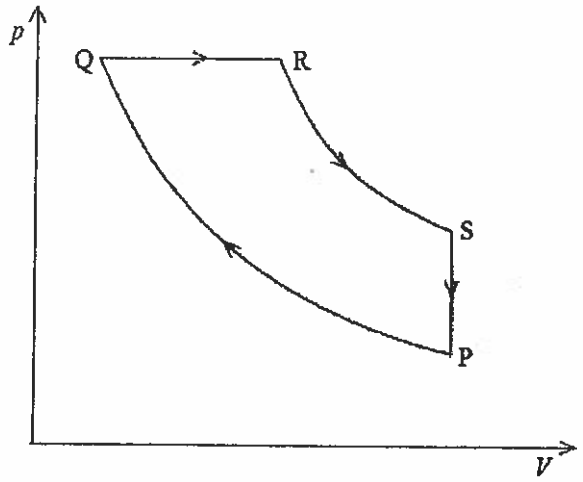
3. The graph below shows the variation of the pressure p with volume V of an ideal gas during one cycle of an engine.



Which of the following correctly names the thermodynamic process associated with the parts Y→Z and Z→X of the cycle?

	Y→Z	Z→X
A.	isobaric	isochoric
B.	isobaric	isothermal
C.	isochoric	isobaric
D.	isochoric	isothermal

4. The diagram shows the pressure/volume (p/V) diagram for one cycle PQRS of an engine.



In which sections of the cycle is work done **on** the engine?

A. SP only

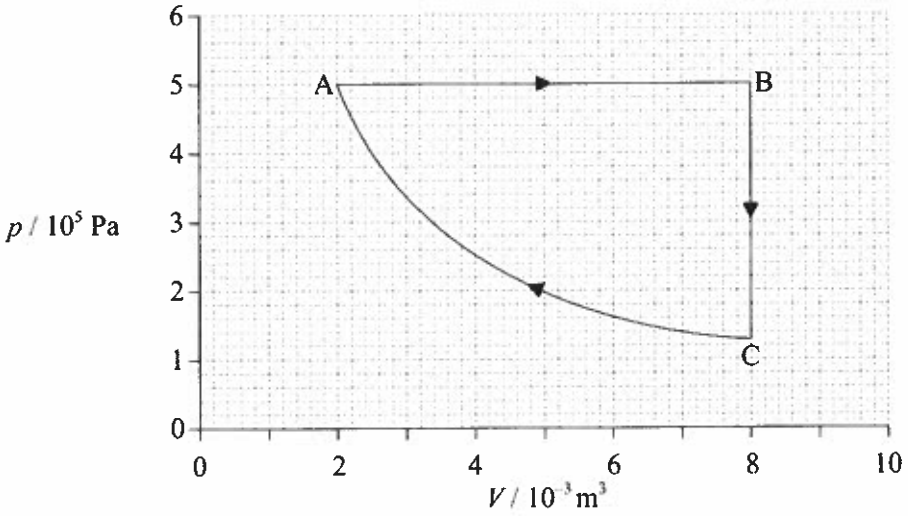
B. PQ only

C. SP and PQ only

D. RS and SP only

(Option B continued)

7. The pressure volume (pV) diagram shows a cycle ABCA of a heat engine. The working substance of the engine is a fixed mass of an ideal gas.



The temperature of the gas at A is 400 K.

(a) Calculate the maximum temperature of the gas during the cycle. *[1]*

. . . . . .

. . . . . .

(Option B continues on the following page)

(Option B, question 7 continued)

(b) For the isobaric expansion AB, calculate the

(i) work done by the gas. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(ii) change in the internal energy of the gas. *[1]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(iii) thermal energy transferred to the gas. *[1]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(Option B continues on the following page)

(Option B, question 7 continued)

(c) The work done on the gas during the isothermal compression is 1390 J. Determine the change in entropy of the gas for this compression. *[2]*

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.....
.....
.....

(d) Determine the efficiency of the cycle ABCA. *[2]*

.....
.....
.....
.....

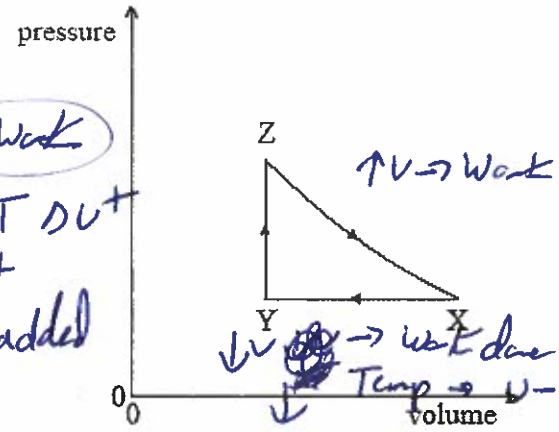
(e) State whether the efficiency of a Carnot engine operating between the same temperatures as those operating in cycle ABCA on page 14, would be greater than, equal to, **or** less than the efficiency in (d). *[1]*

.....

End of Option B

More Practice Option B2

1. The diagram shows the pressure volume relationship for a fixed mass of an ideal gas that undergoes a cycle XYZ.



No ΔV - No Work

↑P → ↑T ΔU+

Gas gets hot

heat must be added

↑V → Work done by gas W+

↓V → work done on gas W−

Temp → U−

Q⁻ Heat Lost = W⁻ work done on gas + ΔU⁻ loss in internal Energy

In which part(s) of the cycle is external work done **on** the gas?

Work W⁻

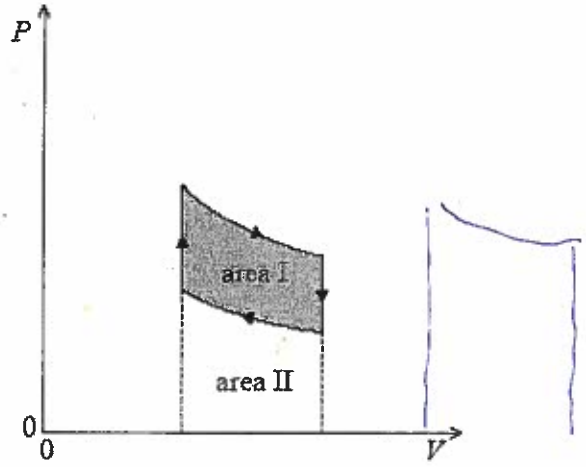
A. Y → Z only

B. Y → Z and Z → X only

C. X → Y and Z → X only

(D) X → Y only

2. The diagram shows the pressure–volume (*PV*) relationship for a gas.



W = Q_H − Q_C

Whole − Q_H

|Q_C|

Which of the following area(s) is/are equal to the work done by the gas as it expands?

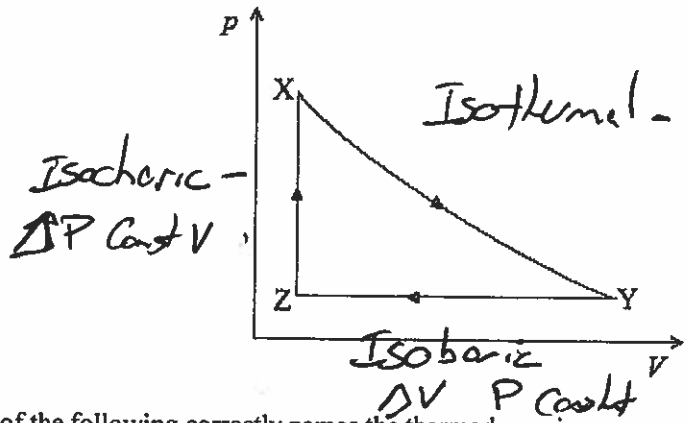
(A) area I

B. area II

(C) area I + area II

D. area I – area II

3. The graph below shows the variation of the pressure p with volume V of an ideal gas during one cycle of an engine.



Isothermal - T is constt

Isochoric - ΔP Const V

Isobaric ΔV P Constt

Which of the following correctly names the thermodynamic process associated with the parts Y→Z and Z→X of the cycle?

	Y→Z	Z→X
A.	isobaric ✓	isochoric ✓
B.	isobaric	isothermal
C.	isochoric	isobaric
D.	isochoric	isothermal

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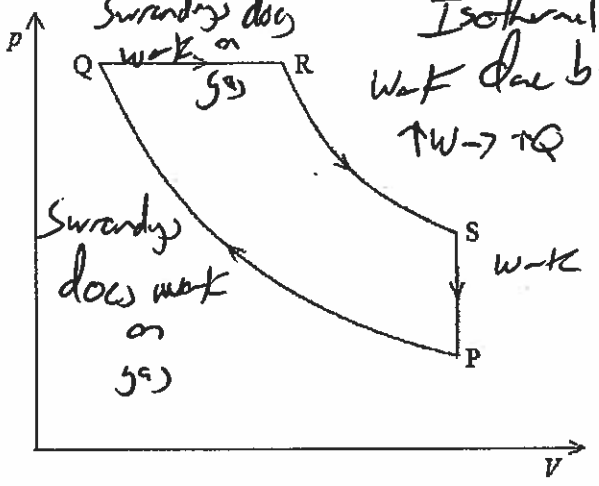


Surrndgs does work on gas

Isothermal

Work done by gas

↑W → ↑Q (Heat gained) - Does work on surrndgs

Surrndgs does work on gas

work done by gas

In which sections of the cycle is work done **on** the engine?

A. SP only

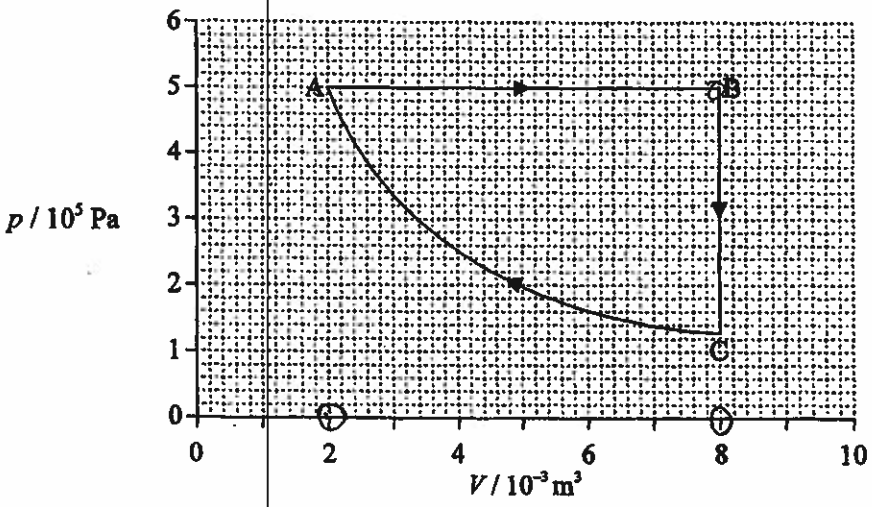
B. PQ only

C. SP and PQ only

D. RS and SP only

(Option B continued)

7. The pressure volume (pV) diagram shows a cycle ABCA of a heat engine. The working substance of the engine is a fixed mass of an ideal gas.



The temperature of the gas at A is 400 K.

(a) Calculate the maximum temperature of the gas during the cycle. *[1]*

at B $\frac{P_A V_A}{T_A} = \frac{P_B V_B}{T_B}$ $T_B = 1600\ K$

$\frac{2 \times 10^{-3}\ m^3}{400\ K} = \frac{8 \times 10^{-3}\ m^3}{T_B}$

(Option B continues on the following page)

(Option B, question 7 continued)

(b) For the isobaric expansion AB, calculate the

(i) work done by the gas. *[2]*

$W = P\Delta V$
$= (5\times10^5\ Pa)(8\times10^{-3} - 2\times10^{-3}\ m^3)$
$= 3000\ J$

(ii) change in the internal energy of the gas. *[1]*

$\Delta U = \frac{3}{2} nR\Delta T$ $\quad PV = nRT$
$n = ?$ $\quad P\Delta V = nR\Delta T$
so
$\Delta U = \frac{3}{2} P\Delta V = \frac{3}{2}(3000\ J) = 4.5\times10^3\ J$

can use $PV=nRT$ if you first solve for n when you know P, V and T.

(iii) thermal energy transferred to the gas. *[1]*

$Q = \Delta U + W$
$= 3\times10^3\ J + 4.5\times10^3\ J$
$Q = 7.5\times10^3\ J$

(Option B continues on the following page)

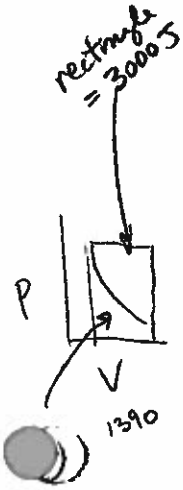
(Option B, question 7 continued)

(c) The work done on the gas during the isothermal compression is 1390 J. Determine the change in entropy of the gas for this compression. *[2]*

$\Delta S = \frac{\Delta Q}{T} = \frac{1390\,J}{400\,K} = -3.48\,\frac{J}{K}$

Neg. bc. the gas is compressed so more organized

(d) Determine the efficiency of the cycle ABCA. *[2]*



$\eta = \frac{\text{useful work}}{\text{Energy input}} = \frac{3000\,J - 1390\,J}{7500\,J} = 0.21$

Q from iii

(e) State whether the efficiency of a Carnot engine operating between the same temperatures as those operating in cycle ABCA on page 14, would be greater than, equal to, or less than the efficiency in (d). *[1]*

Carnot cycle efficiency is greater

End of Option B