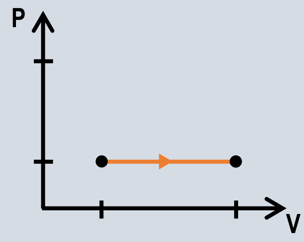
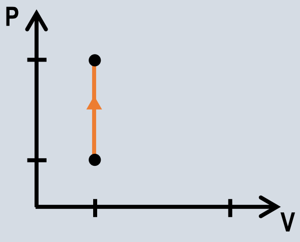
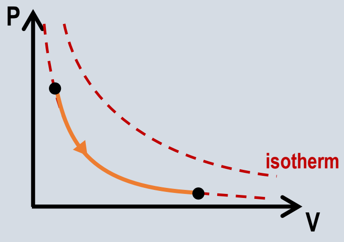
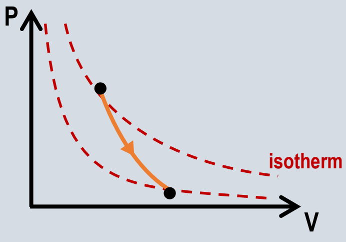
CONCEPT: HEAT EQUATIONS FOR ISOBARIC AND ISOVOLUMETRIC PROCESSES

- We know the work equations for isobaric and isovolumetric processes, but you'll also need to know the heat equations.

SPECIAL THERMODYNAMIC PROCESSES

	Isobaric (Constant P)	Isovolumetric (Constant V) a.k.a. *"Isochoric"*	Isothermal (Constant T)	Adiabatic (Q = 0)
	 ● Straight Horizontal line	 ● Straight Vertical line	 ● "Isotherm" Curve (1 for each T) ● Farther from origin = Higher T	 ● No Heat Transfer ● Steeper than isotherms
ΔE_{int}	$Q - W$	$\Delta E_{int} = Q$	0	$\Delta E_{int} = -W$
Q	$Q =$ ________	$Q =$ ________	$Q = W$	0
W	$P\Delta V$	0	$nRT \cdot \ln\left(\frac{V_f}{V_i}\right)$	

- Remember: we used $Q = mc\Delta T$ for solids & liquids, but we use a different EQ for gases.
  - Remember: c = specific heat *per* **kg**.
  - For gases, we use C = specific heat *per* ________ (a.k.a molar specific heat)

C_P = Molar Specific Heat at constant pressure

C_V = Molar Specific Heat at constant volume

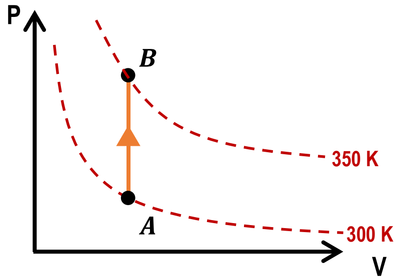
- Values for C_V & C_P depend only on gas type.

GAS TYPE	C_V	C_P
Monoatomic	$\frac{3}{2}R$	$\frac{5}{2}R$
Diatomic	$\frac{5}{2}R$	$\frac{7}{2}R$

THERMO CONSTANTS

$R = 8.314 \frac{J}{mol \cdot K}$

EXAMPLE: 3 mol of a monoatomic gas undergo the process shown below. Calculate ΔE_{int}.

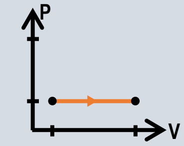
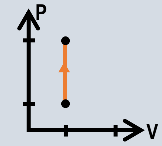
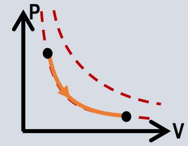
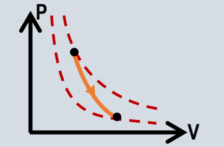


- Remember: the farther away from the origin, the higher the temperature.

  If process goes *away from origin*, Q & ΔT are [+ | –]

  If process goes *toward origin*, Q & ΔT are [+ | –], PROBLEM: How much heat energy is needed to increase the temperature of 5 mol of an ideal diatomic gas by from 273K to 300K if the **a)** pressure is held constant; **b)** the volume is held constant?

- **A)** 3928 J ; 2806 J
- **B)** 3928 J; 1683 J
- **C)** 135 J ; 135 J
- **D)** 3.97×10^4 J ; 4.36×10^4 J

	Iso-P	Iso-V	Iso-T	Adiabatic (Q=0)
				
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Q	$nC_P\Delta T$	$nC_V\Delta T$	$Q = W$	0
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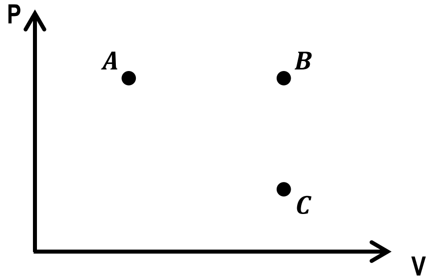
<u>PROBLEM</u>**:** 3 mol of a monoatomic gas are initially at 293K at point **A.** You add 2000J of heat to the gas at constant pressure until it reaches point **B**, then remove 2000J of heat at constant volume until it reaches point **C.** Draw these processes on the PV diagram and calculate the temperature of the gas at point **C.**



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	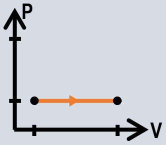	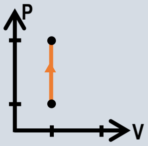	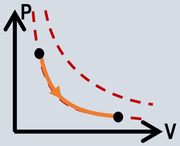	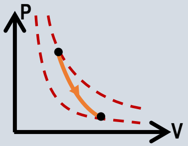
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