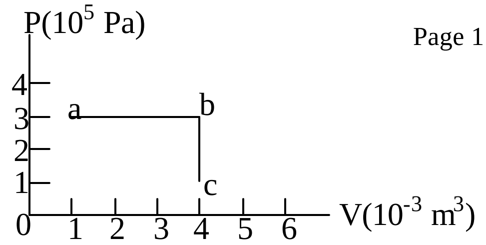
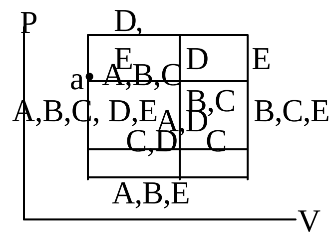
12-1A) At the right is a graph of pressure vs volume for a substance. How much work, W_{out}, is done by the substance as P and V change when it goes from a $\rightarrow$b$\rightarrow$c?

(a) 300 J (b) 800 J (c) -900 J (d) -300 J (e) 900 J



12-2A) A system can be taken around a closed cycle from state a back to state a by five different paths shown at the right. For which path is the work done by the system LARGEST?

(a) A (b) B (c) C (d) D (e) E



An ideal gas at fixed pressure P = 2 x 10^5 Pa and initial volume V_o = 1 x $10^{-3}$$m^3$ expands in such a way that its temperature doubles.

12-3A) How much work is done by the gas?

(a) 200 J (b) –200 J (c) 100 J (d) –100 J (e) You don't have enough information to tell.

12-4A) What is the ratio of the final internal energy of the ideal gas to its initial internal energy?

(a) 0.5 (b) 2 (c) 4 (d) 1.5 (e) 1

12-5A) You put heat Q = 30 J into a system and the system does W = 10 J of work. What is the change in internal energy, ΔU, of the system?

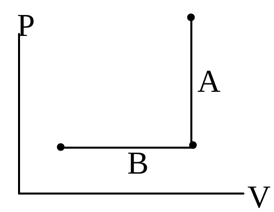
(a) –20 J (b) -40 J (c) + 20 J (d) + 40 J (e) None of these is close.

12-6A) When 5 g of water is boiled at constant temperature and one atmosphere pressure (1x10^5 Pa), it expands to a volume of about 8000 cm^3 of steam. Given the density of water = 1 g/cm^3, by about how much does the internal energy of the system increase? (Assume that all of the heat input goes just to boil the water and that none of this heat is lost. $L_v(H_2 0)$ = 540 cal/gm. 1 cal = 4.2 J)

(a) 11,300 J (b) 800 J (c) 10,500 J (d) 1900 J (e) 12,100 J

12-7A) Consider the two processes A and B shown at the right for an ideal gas. Using + to indicate Heat In, Q_{in}, and – to indicate Heat Out, Q_{out}, which One of the following correctly describes A and B in that order?

(a) +, + (b) -, - (c) +, - (d) -, + (e) You don't have enough information to tell.



12-8A) Which one of the following statements is WRONG?

(a) In an isothermal process, the internal energy of an ideal gas does not change.
(b) Given any two bodies, the one with the higher temperature contains more heat.
(c) At thermodynamic equilibrium, the internal energy U of a given system is an intrinsic property of the state of the system, independent of the processes by which that state was reached.
(d) Heat, Q, and Work, W, are both path dependent quantities--i.e., the same change in the internal energy of a substance can be obtained using different amounts of Q and W by taking the substance through different paths.
(e) An adiabatic process is one in which no heat is transferred between the system of interest and its surroundings.

12-9A) An engine has an efficiency ε = 25%. How much work (in cal) can the engine do with Q_h = 20 cal?

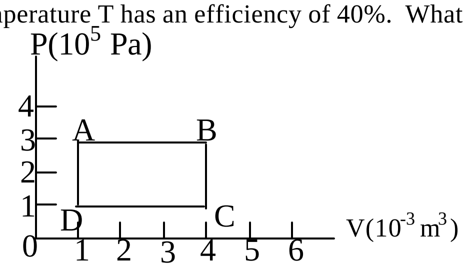
(a) 5 cal (b) 20 cal (c) 80 cal (d) 25 cal (e) None of these is close.

12-10A) An ideal engine operating between room temperature (20^oC) and higher temperature T has an efficiency of 40%. What is T?

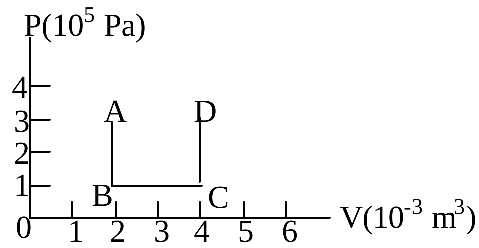
(a) 50^oC (b) 488^oC (c) 33^oC (d) 215^oC (e) 460^oC

12-11A) What is the total heat input Q into the system shown at the right when it is taken completely around the closed cycle ABCD?

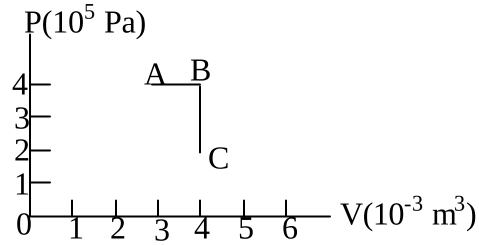
(a) 600 J (b) 900 J (c) 300 J (d) 800 J (e) zero



12-12A) The figure at the right shows a PV cycle for a system. The internal energy at point A is 300 J. If, when the system is taken around the path $A \rightarrow B \rightarrow C \rightarrow D$, 400 J of heat is put into the system, what is the internal energy of the system at point D?
(a) 900 J (b) 100 J (c) -300 J (d) 500 J (e) 200 J

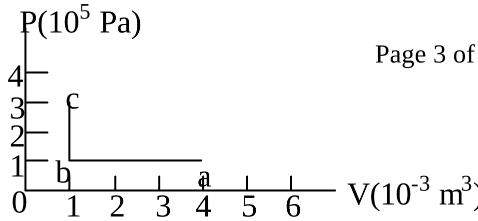


12-13A) The graph at the right shows how the pressure and volume of a perfect gas change as the gas is taken through a constant pressure expansion from A to B and then a constant volume process from B to C. If the internal energies at points A and C are U_A = 1200 J & U_C = 900 J, then how much heat, Q_{in} must flow into the gas as it goes from A to C?
(a) +900 J (b) +700 J (c) -900 J (d) +100 J (e) None of these



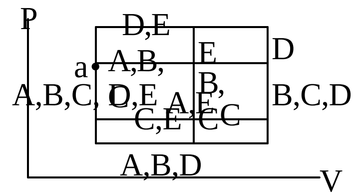
12-14A) About what is the change of entropy of an ice cube of mass 100g that melts at 0^oC? (Take L_m = 80 cal/g; 1 cal = 4.2J).
(a) 34,000 J (b) infinity because T = 0 (c) 1.2 J/K (d) 9,170,000 J/K (e) 123 J/K

12-15A) In a thermal conduction experiment, heat of Q = 70 J is taken from a reservoir at 77^oC and deposited into a reservoir at 7^oC. What are the entropy changes of the hot and cold reservoirs and of the Universe?
(a) + 0.2 J/K; -0.25 J/K; -0.05 J/K (b) - 0.2 J/K; -0.25 J/K; +0.45 J/K (c) - 0.2 J/K; +0.25 J/K; +0.05 J/K
(d) - 0.2 J/K; - 0.25 J/K; -0.45 J/K (e) + 0.2 J/K; +0.25 J/K; +0.05 J/K



12-1B) At the right is a graph of pressure vs volume for a substance. How much work, W_{out} is done by the substance as P and V change when it goes from a $\rightarrow$b$\rightarrow$c?

(a) 300 J (b) 800 J (c) -900 J (d) -300 J (e) 900 J



12-2B) A system can be taken around a closed cycle from state a back to state a by five different paths shown at the right. For which path is the work done by the system LARGEST?

(a) A (b) B (c) C (d) D (e) E

An ideal gas at fixed pressure P = 2 x 10^5 Pa and initial volume V_o =1 x 10^{-3}m^3 expands in such a way that its temperature increases by half.

12-3B) How much work is done by the gas?

(a) 100 J (b) 200 J (c) 400 J (d) – 100 J (e) You don't have enough information to tell.

12-4B) What is the ratio of the final internal energy of the ideal gas to its initial internal energy?

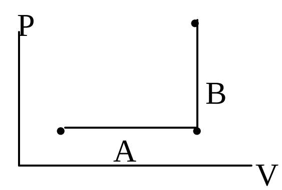
(a) 1.0 (b) 2.0 (c) 1.5 (d) 4.0 (e) You don't have enough information to tell.

12-5B) You do work W = 10 J on a system and take heat Q = 30 J out of the system. What is the change in internal energy, ΔU, of the system?

(a) –40 J (b) -20 J (c) + 20 J (d) + 40 J (e) None of these is close.

12-6B) When 2 g of water is boiled at constant temperature and one atmosphere pressure (1x10^5 Pa), it expands to a volume of about 3200 cm^3 of water vapor. Given the density of water = 1 g/cm^3, find the increase in the internal energy of the system. (Assume that all of the heat input goes just to boil the water and that none of this heat is lost. $L_v(H_20)$ = 540 cal/gm. 1 cal = 4.2 J)

(a) 320 J (b) 4,500 J (c) 760 (d) 4,800 J (d) 760 J (e) 4,200 J



12-7B) Consider the two processes A and B shown at the right for an ideal gas. Using + to indicate Heat In, Q_{in}, and – to indicate Heat Out, Q_{out}, which One of the following correctly describes A and B in that order?

(a) +, + (b) -, - (c) +, - (d) -, + (e) You don't have enough information to tell.

12-8B Which one of the following statements is WRONG?

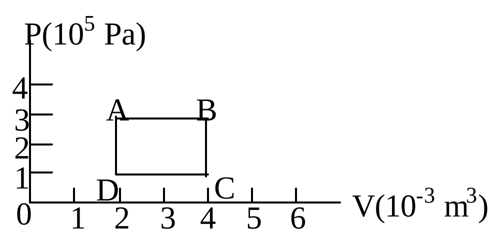
(a) In an isothermal process, the internal energy of an ideal gas increases.
(b) Given two otherwise identical ideal gasses, the one with the higher temperature has the higher internal energy.
(c) At thermodynamic equilibrium, the internal energy U of a given system is an intrinsic property of the state of the system, independent of the processes by which that state was reached.
(d) Heat, Q, and Work, W, are both path dependent quantities--i.e., the same change in the internal energy of a substance can be obtained using different amounts of Q and W by taking the substance through different paths.
(e) An adiabatic process is one in which no heat is transferred between the system of interest and its surroundings.

12-9B) An engine has an efficiency ε = 25%. How much work (in cal) can the engine do with Q_c = 30 cal?

(a) 7.5 cal (b) 30 cal (c) 40 cal (d) 10 cal (e) None of these is close.

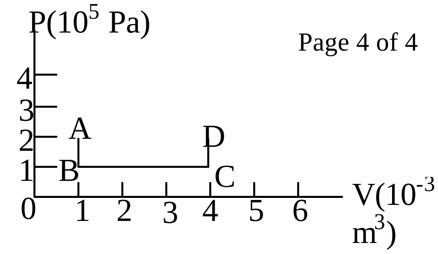
12-10B) An ideal engine operates between room temperature (20^{o}C) and T = 60^{o}C. About what is its efficiency?

(a) 67% (b) 200% (c) 33% (d) 15% (e) 12%



12-11B) What is the total heat input Q into the system shown at the right when it is taken completely around the closed cycle ABCD?

(a) 450 J (b) 300 J (c) 400 J (d) 150 J (e) zero

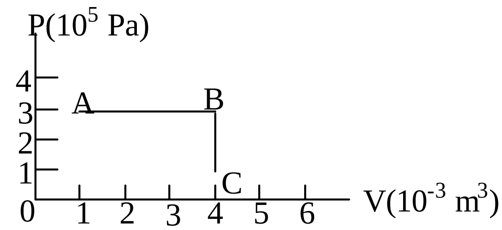


12-12B) The figure at the right shows part of a PV cycle for a system. The internal energy at point A is 600 J. If, when the system is taken around the path A → B → C → D, 500 J of heat is put into the system, what is the internal energy of the system at point D?

(a) 400 J (b) 800 J (c) 1400 J (d) –200 J (e) 600 J

12-13B) The graph at the right shows how the pressure and volume of a perfect gas change as the gas is taken through a constant pressure expansion from A to B and then a constant volume process from B to C. If the internal energies at points A and C are U_A = 900 J & U_C = 1200 J, then how much heat, Q_{in} must flow into the gas as it goes from A to C?

(a) -900 J (b) +600 J (c) 1200 J (d) +100 J (e) None of these



12-14B) About what is the change of entropy of an ice cube of mass 200 g that melts at 0^oC? (Take L_m = 80 cal/g; 1 cal = 4.2J).

(a) 246 J/K (b) infinity because T = 0 (c) 34,000 J/K (d) 2.4 J/K (e) 18,340,000 J/K

12-15B) In a thermal conduction experiment, heat of Q = 50 J is taken from a reservoir at 50^oC and deposited into a reservoir at 0^oC. What are the entropy changes of the hot and cold reservoirs and of the Universe?

(a) + 0.15 J/K; -0.18 J/K; -0.03 J/K (b) - 0.15 J/K; -0.18 J/K; +0.33 J/K (c) - 0.15 J/K; +0.18 J/K; +0.03 J/K

(d) - 0.15 J/K; - 0.18 J/K; -0.33 J/K (e) + 0.15 J/K; +0.18 J/K; +0.03 J/K

12-1A) e 2A) e 3A) a 4A) b 5A) c 6A) c 7A) b 8A) b 9A) a 10A) d 11A) a 12A) d 13A) d 14A) e 15A) c

12-1B) d 2B) d 3B) a 4B) c 5B) b 6B) e 7B) a 8B) a 9B) d 10B) e 11B) c 12B) b 13B) c 14B) a 15B) c