



PHYSICS

BOOKS - PSEB

THERMODYNAMICS

Exercise

1. A geyser heats water flowing at the rate of 3.0 litres per minute from $27^{\circ}C$ to $77^{\circ}C$. If the geyser operates on a gas burner, what is

the rate of consumption of the fuel if its heat of combustion is $4.0 \times 10^4 J/g$?



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2. What amount of heat must be supplied to $2.0 \times 10^{-2} kg$ of nitrogen (at room temperature) to raise its temperature by $45^\circ C$ at constant pressure ? (Molecular mass of $N_2 = 28$, $R = 8.3 J mol^{-1} K^{-1}$.)



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3. Explain why Two bodies at different temperatures T_1 and T_2 if brought in thermal contact do not necessarily settle to the mean temperature $(T_1 + T_2) / 2$.



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4. Explain why The coolant in a chemical or a nuclear plant (i.e., the liquid used to prevent the different parts of a plant from getting too hot) should have high specific heat.



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5. Explain why Air pressure in a car tyre increases during driving.



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6. Explain why The climate of a harbour town is more temperate than that of a town in a desert at the same latitude.



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7. A cylinder with a movable piston contains 3 moles of hydrogen at standard temperature and pressure. The walls of the cylinder are made of a heat insulator, and the piston is insulated by having a pile of sand on it. By what factor does the pressure of the gas increase if the gas is compressed to half its original volume ?



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8. In changing the state of a gas adiabatically from an equilibrium state A to another equilibrium state B, an amount of work equal to 22.3 J is done on the system. If the gas is taken from state A to B via a process in which the net heat absorbed by the system is 9.35 cal, how much is the net work done by the system in the latter case ? (Take 1 cal = 4.19 J)



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9. Two cylinders A and B of equal capacity are connected to each other via a stopcock. A contains a gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stopcock is suddenly opened. Answer the following : What is the final pressure of the gas in A and B ?



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10. Two cylinders A and B of equal capacity are connected to each other via a stopcock. A contains a gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stopcock is suddenly opened. Answer the following : What is the change in internal energy of the gas ?



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11. Two cylinders A and B of equal capacity are connected to each other via a stopcock. A contains a gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stopcock is suddenly opened. Answer the following : What is the change in the temperature of the gas ?



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12. Two cylinders A and B of equal capacity are connected to each other via a stopcock. A contains a gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stopcock is suddenly opened. Answer the following : Do the intermediate states of the system (before settling to the final equilibrium state) lie on its P-V-T surface ?



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13. A steam engine delivers $5.4 \times 10^8 J$ of work per minute and services $3.6 \times 10^9 J$ of heat per minute from its boiler. What is the efficiency of the engine? How much heat is wasted per minute?

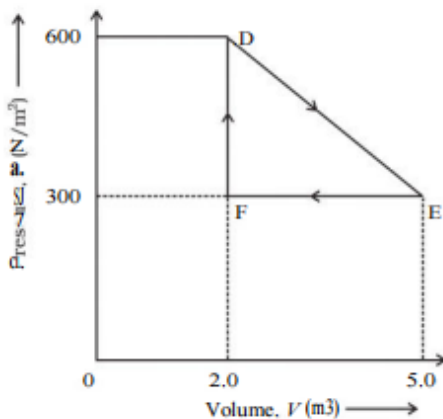


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14. An electric heater supplies heat to a system at a rate of 100W. If the system performs work at a rate of 75 joules per second. At what rate is the internal energy increasing?



15. A thermodynamic system is taken from an original state to an intermediate state by the linear process shown in Fig. (12.13) Its volume is then reduced to the original value from E to F by an isobaric process. Calculate the total work done by the gas from D to E to F :





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16. A refrigerator is to maintain eatables kept inside at $9^{\circ}C$. If room temperature is $36^{\circ}C$, calculate the coefficient of performance.



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