

國立彰化師範大學105學年度碩士班招生考試試題

系所： 車輛科技研究所

選考己

科目： 熱力學

☆☆請在答案紙上作答☆☆

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1. Describe the difference between the terms in each of the following sets: (20%)
 - (a) macroscopic and microscopic
 - (b) work and power
 - (c) adiabatic and isothermal
 - (d) totally reversible process and internally reversible process
2. Briefly define the following terms: (25%)
 - (a) thermodynamic equilibrium
 - (b) the first law of the thermodynamics
 - (c) ideal gas
 - (d) the Clausius statement of the second law of the thermodynamics
 - (e) the Kelvin-Planck statement of the second law of the thermodynamics
3. A worker pressurizes a rigid pipe (30 mm inside diameter, 20 m long) with dry air to check for leaks. The temperature and absolute pressure of the air in the pipe are 35°C and 205kpa. The worker returns 24h later and the absolute pressure has dropped to 183kpa, while the air temperature inside the pipe has decreased to 21°C . Has the pipe leaked? If so, calculate the mass of air that has leaked through the fittings. (15%)
4. The combustion gases within an enclosed piston and cylinder expand such that the gas pressure-cylindrical volume relationship follows the path
$$PV^{1.5} = C$$
where C is a constant. The gas pressure at the beginning of the power stroke is 3 MPa when the volume within the cylinder is 50 cm^3 . At the end of the stroke the cylinder volume is 1200 cm^3 . Calculate the work developed by the gas during a single stroke of this piston and the average power developed by the gas if there are 20 power strokes per second. (15%)
5. An automobile tire is inflated to an absolute pressure of 310kpa at a temperature of 20°C . After a trip the temperature of the air in the tire increases to 45°C , while the volume of the tire increases by 2 percent owing to stretching of the tire material. Calculate the air pressure in the tire after the trip. (15%)
6. A residential air-source heat pump is used to provide heating during the winter season. A house is to be maintained at 21°C , and on a typical day the heat transfer from the house amounts to 75000kJ/h when the outdoor-air temperature is -4°C . The heat pump has a coefficient of performance of 3.7 under these conditions. Determine the power input required for the heat pump and the heat-transfer rate to the heat pump from the outdoor. (10%)