PHYS1013 Mid-semester test
2022

PLEASE PUT YOUR NAME AND TUTOR ON ALL SHEETS

40 minutes long

1. Compute the molar specific heat capacity, C_V, for ammonia (NH_3). Sketch how you would expect it to vary with temperature. [7 marks]

2. Near the Earth's surface, the temperature increases on average by 1°C for every 30 m of depth. The average thermal conductivity of the Earth's crust is 0.74 $Wm^{-1}K^{-1}$ and the Earth's radius is 6370 km. What is the Earth's rate of heat loss due to conduction from the hot core? [4 marks]

3. 1m^3 of nitrogen (N_2, C_V=5R/2) is adiabatically compressed from s.t.p. to 1/5th the volume. How much work was done on the gas? [6 marks]

4. Draw a diagram of a Carnot engine in refrigerator mode and state it's efficiency in terms of the work provided and the reduced thermal energy in the fridge. [3 marks]

Standard temperature and pressure, s.t.p., is 1.01×10^5 Pa and 0°C