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13 A weather balloon takes scientific equipment high into the atmosphere to monitor atmospheric conditions. A weather balloon is filled with hydrogen at a temperature of 22.5 °C and a pressure of  $1.02 \times 10^5$  Pa. The volume of the balloon is  $7.50 \,\mathrm{m}^3$ . The balloon rises through the atmosphere to a maximum height. At the maximum height, the temperature of the hydrogen in the balloon is -48.0 °C and the pressure of the hydrogen in the balloon is  $8.40 \times 10^4 \, \mathrm{Pa}$ . (a) Calculate the volume of the balloon at the maximum height. (3) Volume of balloon = (b) Calculate the decrease in the mean kinetic energy of a hydrogen molecule in the balloon as the balloon rises to the maximum height. (2) Decrease in mean kinetic energy =

(Total for Question 13 = 5 marks)