A weather balloon rising through the atmosphere, has its volume expanding from 6.0 m^3 to 15 m^3 as the temperature drops from 22°C to - l2°C. If the initial gas pressure inside the balloon is 1.0 atm, what is the final pressure?

Given:

Initial volume of the balloon: $V_i = 6.0\ m^3$

Final volume of the balloon: $V_f = 15\ m^3$

Initial temperature in the balloon: $T_i = 22^{\circ}C = 295\ K$

Final temperature in the balloon: $T_f = -12^{\circ}C = 261\ k$

Initial gas pressure in the balloon: $P_i = 1.0\ atm$

To determine: final gas pressure in the balloon: P_f

Use formula:

$PV = nRT$ ----------(1)

R is the gas constant and has a value of 8.314 J / mol

Then:

$P_iV_i = nRT_i$ ----------(2)

$P_fV_f = nRT_f$ ---------- -(3)

Combining (2) & (3) and rearranging:

$P_f = P_iV_iT_f / V_fT_i$ ----------(4)

Substituting P_i, V_i, T_i, T_f and V_f in (4):

P_f = (1.0 ×6 × 261) / (15 × 295) = 0.35 atm