G2.4 In the table fill out the missing initial ('$_1$') or final ('$_2$') values:

P_1 /Pa	V_1 /cm^3	T_1 /K	P_2 /Pa	V_2 /cm^3	T_2 /K
1.01×10^5	30	300	(a)	20	300
1.01×10^5	30	300	(b)	30	373
1.01×10^7	2.0	600	1.01×10^5	(c)	300
1.01×10^5	500	(d)	1.01×10^7	10	4.0

G2.5 A tyre contains 800 cm^3 of air at a pressure of about 5.0×10^5 Pa at 9.0 °C. After a cycle ride, the volume is 810 cm^3 and the temperature is now 25 °C. Assuming that none of the gas has leaked, what is the new pressure?

G2.6 A tyre contains 800 cm^3 of air at a pressure of about 5.0×10^5 Pa at 9.0 °C. After a cycle ride, the volume is 760 cm^3, the temperature is now 25 °C, and the pressure is 4.0×10^5 Pa. What percentage of the gas molecules have leaked out?

G2.7 A water fire extinguisher contains 4.0 litres of air at 10^7 Pa and 20 °C. When the extinguisher is used, this gas forces the water out. Calculate the pressure when the volume has increased to 10 litres and the temperature has dropped to 3.0 °C.

G3 Heat Capacity

$^{10}/_{13}$

Data: Specific heat capacity of water = 4180 J kg^{-1} K^{-1}
Specific heat capacity of aluminium = 880 J kg^{-1} K^{-1}
Specific heat capacity of iron = 435 J kg^{-1} K^{-1}
Specific heat capacity of paraffin = 2130 J kg^{-1} K^{-1}

G3.1 Complete the values in the table :

Energy /J	Material	Mass /kg	Initial temperature	Final temperature
(a)	Aluminium	0.290	15 °C	82 °C
45 200	Paraffin	2.30	3.0 °C	(b)
81 000	Water	1.50	11 °C	(c)

G3.2 How much time will it take a 2300 W kettle to heat 2.31 kg of water from $12\ ^\circ$C to $100\ ^\circ$C? Assume no heat is lost to the surroundings.

G3.3 How much water can a shower head heat each second from $12\ ^\circ$C to $41\ ^\circ$C if the heater has a power of 4200 W? Assume that no heat is lost to the surroundings, and give your answer in kilograms.

G3.4 If 0.024 kg of water gets trapped in the shower heater of question G3.3, the thermal sensor must stop the current before the water reaches $80\ ^\circ$C. Assuming that the water is at $35\ ^\circ$C when the fault occurs, how quickly must the thermal sensor act?

G3.5 A radiator is made using 5.4 kg of iron. It is then filled with 7.3 kg of water. Calculate its heat capacity, that is the heat required to raise the temperature of the whole thing by $1.0\ ^\circ$C.

G3.6 In the following questions, two substances are mixed. In each case work out the missing mass m or temperature t, assuming no heat is lost to the surroundings.

First substance			Second substance			Mixture
Material	m_1 /kg	t_1 /°C	Material	m_2 /kg	t_2 /°C	t_{mix} /°C
Water	3.2	83	Paraffin	4.3	18	(a)
Water	0.34	14	Iron	0.15	230	(b)
Water	1.25	56	Paraffin	(c)	170	84
Aluminium	3.2	12	Paraffin	2.1	(d)	51

G3.7 How much water at $52\ ^\circ$C must I add to 19 kg of water at $21\ ^\circ$C to make it the right temperature, $37\ ^\circ$C for me to bath a baby?

G3.8 If I add 210 g of rivets, made of some unknown metal, at $303\ ^\circ$C to 500 g of water at $15\ ^\circ$C, and the final temperature is $34\ ^\circ$C, what is the specific heat capacity of the mystery metal?