Significant figures solutions

1) Calculate the pressure exerted by 6.9 g of argon in a 0.07500 L container at 11.5 °C.'
The answer must be expressed to two significant figures as the as 6.9 g of argon has two significant figures.
All three pieces of supplied data (6.9 g, 0.07500 L and 11.5 ^{o}C), as well as the gas constant (8.31) obtained from the data sheet and the molar mass of argon (39.9), are used in calculating the pressure. The calculated pressure should have been expressed to the same number of significant figures as the piece of data used in the calculations that had the fewest significant figures, i.e. two significant figures consistent with 6.9 g of argon
PV=nRT
P = nRT/V
P = (6.9/39.9) X 8.31 X 284.5 / 0.07500
P = 5500 kPa = 5.5 X 10^{3} kPa

2) 20.00 mL of vinegar was titrated with a 0.11M NaOH solution.
NaOH reacts with acetic acid according to the equation below.
$CH_3COOH(aq) + NaOH(aq) \rightarrow CH_3COONa(aq) + H_2O(l)$
Three concordant titres were obtained and the average titre was 15.35 mL. Find the concentration of the vinegar solution to the right number of significant figures.
Concentration of titrated vinegar = (0.11 x 15.35)/20.00 = 0.0844 M = 8.4 X 10^{-2}M

3) *Methanol*, CH_3OH, undergoes combustion according to the equation
$2CH_3OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 4H_2O(g)$
In an experiment to determine its suitability as a fuel, a sample of methanol underwent complete oxidation in a bomb calorimeter. The calorimeter was first calibrated by passing a current through an electric heater placed in the water surrounding the reaction vessel. A potential of 5.251 volts was applied for 3.00 minutes. The measured current was 1.50 amperes and the temperature of the water and reaction vessel increased by 0.593 °C.

i. Determine the amount of energy, in kJ, supplied to the bomb calorimeter.
Energy (Joules) = Voltage X amperes X seconds
Energy = 5.251V X 1.50A X 3.00 X 60 = 1.42 kJ
The least number of significant figures in this calculation is 3. The number 60 (seconds in one minute) is a constant and so can have as many significant numbers as necessary.

ii. Determine the calibration constant, in kJ $°C^{-1}$, for the calorimeter and its contents.
1.42 kJ / 0.593 = 2.39 kJ$^{o}C^{-1}$

4) Four 20.00 mL aliquots of a solution of HCl of unknown concentration were titrated against a 0.4521 M NaOH, the results are shown on the table on the left.

Trial	1	2	3	4
Final burette reading / cm^3	25.11	39.12	14.15	28.20
Initial burette reading / cm^3	10.10	25.11	0.15	14.15
Volume used / cm^3	15.01	14.01	14.0	14.05

a) Find the average titre using the three concordant results.
(14.01 + 14.0 + 14.05) / 3 = 42.1 /3 = 14.0 (Expressed to three sig figs. Note the three is a constant and has as many sig figs as needed)
b) Find the concentration of the HCl solution.
Step 1 find the mol of NaOH needed to titrate the 20.00 mL of HCl this will be the same amount in mol of HCl in the 20.00 mL aliquot.
=> 0.4521 X 0.0140 = 6.33 X 10^{-3} mol
Step 2 find the concentration of HCl
=> 0.00633mol / 0.0200 L = 0.3165 M = 0.317 M