# HSC Chemistry Data Sheet

Original worked revision examples with notes on units and assumptions.

Use the board PDF below for the official sheet. Coverage of examples varies by subject.

## Official reference material

Official NESA reference PDF

## What to work out beyond the sheet

The data sheet supplies reference values. Use a balanced chemical equation to work out mole ratios for the particular reaction.

## Formulas and worked examples

### Amount · mass to moles

Formula or reference: $n = m/M$

Units and conditions: Use mass in g and molar mass in g/mol to get mol.

Worked example: A sample of mass 9.00 g and molar mass 180 g/mol contains 9.00/180 = 0.0500 mol.

### Solutions · molarity

Formula or reference: $c = n/V$

Units and conditions: Amount in mol, volume in litres and concentration in mol/L.

Worked example: Dissolve 0.015 mol and make the final volume 250 mL. The concentration is 0.015/0.250 = 0.060 mol/L.

### Gases · ideal gas law

Formula or reference: $PV = nRT$

Units and conditions: Use kelvin, pressure in Pa and volume in $m^3$ with $R = 8.314$ J/(mol K).

Worked example: At 300 K and 100,000 Pa, 0.20 mol occupies $(0.20 \times 8.314 \times 300)/100{,}000 \approx 0.00499$ $m^3$, or 4.99 L.

### Thermochemistry · heat

Formula or reference: $q = mc\Delta T$

Units and conditions: With mass in kg and c in J/(kg K), q is in joules. Temperature differences in kelvin and °C have the same numerical value.

Worked example: Warming 0.10 kg of water by 4.0 K at $c = 4180$ J/(kg K) transfers 1672 J to the water.

### Thermochemistry · Gibbs energy

Formula or reference: $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$

Units and conditions: T in kelvin. Convert $\Delta S^\circ$ so that $T\Delta S^\circ$ and $\Delta H^\circ$ use the same energy unit.

Worked example: At 300 K, $\Delta H^\circ = -18$ kJ/mol and $\Delta S^\circ = -40$ J/(mol K) give $\Delta G^\circ = -18 - (-12) = -6$ kJ/mol.

### Acids · pH

Formula or reference: $pH = -\log_{10}([H^+])$ in the concentration approximation.

Units and conditions: Use the numerical molar concentration relative to 1 mol/L. pH is unitless.

Worked example: A dilute solution with $[H^+] = 1.0 \times 10^{-3}$ mol/L has pH 3.00.

## Acids · pKa

Formula or reference: $pKa = -\log_{10}(Ka)$

Units and conditions: Use the stated value of Ka. pKa is unitless.

Worked example: An acid with $Ka = 1.0 \times 10^{-5}$ has $pKa = 5.00$.

## Visible spectroscopy · Beer–Lambert law

Formula or reference: $A = \varepsilon \ell c = \log_{10}(I_0/I)$

Units and conditions: Absorbance is unitless. Use matching path length and absorptivity units.

Worked example: At the chosen wavelength, transmitted intensity one quarter of the incident intensity gives $A = \log_{10}(4) \approx 0.602$.

## Infrared spectroscopy · carbonyl band

Formula or reference: Compare the measured wavenumber with the C=O range, 1680–1750 $cm^{-1}$ on this sheet.

Units and conditions: Wavenumber in $cm^{-1}$.

Worked example: A strong peak at 1715 $cm^{-1}$ is consistent with a carbonyl. Use other peaks or chemical evidence to distinguish a ketone from other carbonyl compounds.

## Electrochemistry · standard cell potential

Formula or reference: $E°cell = E°cathode - E°anode$ using the listed reduction potentials.

Units and conditions: Both potentials in volts.

Worked example: If $E°cathode = +0.40$ V and $E°anode = -0.20$ V, $E°cell = +0.60$ V.