

## CONSTANTS

Description	Value
Ideal gas constant ( $R$ )	$0.0821 \text{ L}\cdot\text{atm}/(\text{mol}\cdot\text{K}) = 8.31 \text{ J}/(\text{mol}\cdot\text{K})$
Faraday constant ( $F$ )	$9.65 \times 10^4 \text{ C}/\text{mol } e^- = 9.65 \times 10^4 \text{ J}/(\text{V}\cdot\text{mol } e^-)$
Boltzmann constant ( $k$ )	$1.38 \times 10^{-23} \text{ J}/\text{K}$
Rydberg constant ( $R_H$ )	$1.097 \times 10^7 \text{ m}^{-1}$
Planck's constant ( $h$ )	$6.63 \times 10^{-34} \text{ J}\cdot\text{s}$
Rydberg constant $\times$ Planck's constant $\times$ speed of light in a vacuum ( $R_Hhc$ )	$2.18 \times 10^{-18} \text{ J}$
Molal freezing point depression constant for water ( $K_f$ )	$1.86^\circ\text{C}/m$
Molal boiling point elevation constant for water ( $K_b$ )	$0.51^\circ\text{C}/m$
Heat of fusion of water ( $\Delta H_{fus}$ )	$334 \text{ J}/\text{g} = 80 \text{ cal}/\text{g} = 6.01 \text{ kJ}/\text{mol}$
Heat of vaporization of water ( $\Delta H_{vap}$ )	$2260 \text{ J}/\text{g} = 540 \text{ cal}/\text{g} = 40.7 \text{ kJ}/\text{mol}$
Specific heat ( $s$ ) of water (liquid)	$4.184 \text{ J}/(\text{g}\cdot\text{K}) = 4.184 \text{ J}/(\text{g}\cdot^\circ\text{C}) = 1.0 \text{ cal}/(\text{g}\cdot^\circ\text{C})$
Dissociation constant of water ( $K_w$ )	$1.0 \times 10^{-14}$ at $25^\circ\text{C}$
Standard atmospheric pressure	$1 \text{ atm} = 760 \text{ mm Hg} = 760 \text{ torr} = 101.325 \text{ kPa}$
Speed of light in a vacuum ( $c$ )	$3.00 \times 10^8 \text{ m}/\text{s}$
1 calorie (cal)	$4.184 \text{ J}$
1 watt (W)	$1 \text{ J}/\text{s}$

## FORMULAS

Description	Formula
Gibbs free energy equation	$\Delta G = \Delta H - T\Delta S$
Nernst equation	$E = E^\circ - \frac{RT}{nF} \ln Q$ $E = E^\circ - \left(\frac{0.0257 \text{ V}}{n}\right) \ln Q \text{ at } 298 \text{ K}$ $E = E^\circ - \left(\frac{0.0592 \text{ V}}{n}\right) \log Q \text{ at } 298 \text{ K}$
Relationship between emf and free energy change for reactants and products in their standard states	$\Delta G^\circ = -nFE^\circ$
Energy change as an electron transitions between energy states	$\Delta E = R_H hc \left( \frac{1}{n_i^2} - \frac{1}{n_f^2} \right)$
Henderson-Hasselbalch equation	$\text{pH} = \text{pK}_a + \log \left( \frac{[\text{conjugate base}]}{[\text{acid}]} \right)$
Coulombs (C)	$C = \text{amperes} \times \text{seconds}$
Photon energy	$E = h\nu$
Speed of light	$c = \lambda\nu$
Nuclear binding energy	$\Delta E = c^2 \Delta m$
Amount of heat ( $q$ )	$q = ms\Delta T$
Root-mean-square speed	$u_{rms} = \sqrt{\frac{3RT}{M}}$
Graham's law of diffusion	$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$
Pressure-volume work (at constant pressure)	$w = -P\Delta V$

### NOTES FOR CHEMISTRY TEST

Not all constants and formulas necessary are listed, nor are all constants and formulas listed used on this test.

While attention has been paid to significant figures, no answer should be considered incorrect solely because of the number of significant figures.