iGCSE CIE Co-ordinated Science 0654 (2019-2021 Syllabus) Formula List

Compiled by J.Wilson January 2020

Biology

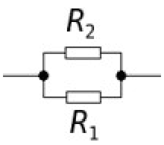
Microscopy	
Actual size = $\frac{\text{image size}}{\text{magnification}}$	

Chemistry

General	
Number of neutrons = nucleon (mass) number – atomic number	
Quantitative chemistry - Moles	
SOLIDS: Number of moles *(mol.)* = $\frac{\text{mass } (g)}{A_r\ (gmol^{-1})}$ or $\frac{\text{mass } (g)}{M_r\ (gmol^{-1})}$	$n = \frac{m}{A_r} = \frac{m}{M_r}$
LIQUIDS: Number of moles *(mol.)* = concentration *(moldm^{-3})* × volume *(dm^{3})*	$n = CV$
LIQUIDS: Concentration *(moldm^{-3})* × volume *(dm^{3})* = concentration *(moldm^{-3})* × volume *(dm^{3})*	$C_1V_1 = C_2V_2$
GASES: Volume of a gas *(m^{3})* = number of moles *(mol.)* × 24 *(m^{3}mol^{-1})* *(at room temperature and pressure)*	$V = 24n$

Physics

General	
Average speed *(ms^{-1})* = $\frac{\text{distance } (m)}{\text{time } (s)}$	
Average velocity *(ms^{-1})* = $\frac{\text{displacement } (m)}{\text{time } (s)}$	$v = \frac{s}{t}$
Acceleration *(ms^{-2})* = $\frac{\text{final velocity } (ms^{-1}) - \text{initial velocity } (ms^{-1})}{\text{time } (s)}$	$a = \frac{v-u}{t}$
Weight *(N)* = mass *(kg)* × gravitational field strength *(ms^{-2})* *Note: Earth's gravitational field strength = 10 ms^{-2}*	$F = mg$
Force *(N)* = mass *(kg)* × acceleration *(ms^{-2})*	$F = ma$
Density *(kgm^{-3})* = $\frac{\text{mass } (kg)}{\text{volume } (m^3)}$	$\rho = \frac{M}{V}$
Hooke's law: Force *(N)* = constant *(Nm^{-1})* × extension *(m)*	$F = kx$
Pressure *(Pa)* = $\frac{\text{force } (N)}{\text{area } (m^2)}$	$P = \frac{F}{A}$
Fluid Pressure *(Pa)* = density *(kgm^{-3})* × gravitational field strength *(ms^{-2} or Nkg^{-1})* × height *(m)*	$P = \rho gh$
Work *(J)* = force *(N)* × distance moved *(m)*	$\Delta E = Fd$
Power *(W)* = $\frac{\text{work } (J)}{\text{time } (s)}$	$P = \frac{\Delta E}{t}$
Kinetic Energy *(J)* = ½ × mass *(kg)* × velocity^2 *(ms^{-1})*	$KE = \frac{1}{2}mv^2$
Gravitational potential energy *(J)* = mass *(kg)* × gravitational field strength *(ms^{-2} or Nkg^{-1})* × height *(m)*	$GPE = mgh$
Efficiency *(%)* = $\frac{\text{useful power output } (W)}{\text{total power input } (W)} \times 100$	Efficiency = $\frac{P_{out}}{P_{in}}$
Efficiency *(%)* = $\frac{\text{useful energy output } (J)}{\text{total energy input } (J)} \times 100$	Efficiency = $\frac{E_{out}}{E_{in}}$
Moment *(Nm)* = force *(N)* × perpendicular distance from pivot *(m)*	$M = Fd$
Sum of clockwise moments *(Nm)* = sum of anticlockwise moments *(Nm)*	$F_1d_1 = F_2d_2$

Thermal	
Boyle's Law for changes in gas pressure at constant temperature : pressure$_1$ *(Pa)* × volume$_1$ *(m^3)* = pressure$_2$ *(Pa)* × volume$_2$ *(m^3)* *or* pressure *(Pa)* × *volume (m^3) = constant*	$P_1V_1 = P_2V_2$ *or* PV = constant
Energy *(J)* = mass *(kg)* × specific heat capacity *($Jkg^{-1}°C^{-1}$)* × temperature change *(°C)*	$E = mc\Delta T$
Electricity	
Current *(A)* = $\frac{\text{charge } (C)}{\text{time } (s)}$	$I = \frac{Q}{t}$
Voltage *(V)* = $\frac{\text{energy transferred } (J)}{\text{charge } (C)}$	$V = \frac{E}{Q}$
Voltage *(V)* = current *(A)* × resistance *(Ω)*	$V = IR$
Power *(W)* = current *(A)* × voltage *(V)*	$P = IV$
Power *(W)* = current^2 *(A)* × resistance *(Ω)*	$P = I^2R$
Energy transferred *(J)* = current *(A)* × voltage *(V)* × time *(s)*	$\Delta E = IVt$
Energy transferred *(J)* = power *(W)* × time *(s)*	$\Delta E = Pt$
Resistors in series: Total Resistance *(Ω)* = sum of individual resistors *(Ω)* 	$R_{TOTAL} = R_1+R_2+R_3+...R_n$
Resistors in parallel: $\frac{1}{\text{total resistance } (\Omega)} = \frac{1}{\text{sum of individual resistors } (\Omega)}$ 	$\frac{1}{R_{TOTAL}} = \frac{1}{R_1} + \frac{1}{R_2} \dots \frac{1}{R_n}$
Resistance *(Ω)* = $\frac{\text{resistivity } (\Omega m) \times \text{length } (m)}{\text{area } (m^2)}$ *Note: since wires have a circular cross section, area = π × radius^2*	$R = \frac{\rho l}{A}$
Transformers: $\frac{\text{voltage in secondary coil } (V)}{\text{voltage in primary coil } (V)} = \frac{\text{turns on secondary coil}}{\text{turns on primary coil}}$	$\frac{V_s}{V_p} = \frac{N_s}{N_p}$
Transformers: $\frac{\text{voltage in primary coil } (V)}{\text{voltage in secondary coil } (V)} = \frac{\text{current in secondary coil } (A)}{\text{current in primary coil } (A)}$	$\frac{V_p}{V_s} = \frac{I_s}{I_p}$
Waves	
Wave speed *(ms^{-1})* = frequency *(Hz)* × wavelength *(m)*	$c = f\lambda$
Frequency *(Hz)* = $\frac{1}{\text{Period } (s)}$	$F = \frac{1}{T}$
Refractive index = $\frac{\text{sine of the angle of incidence, i}}{\text{sine of the angle of refraction, r}}$	$n = \frac{\sin_i}{\sin_r}$
Refractive index = $\frac{\text{speed of light in vacuum}}{\text{speed of light in material}}$	$n = \frac{c_v}{c_m}$
Refractive index = $\frac{1}{\text{sine of critical angle}}$	$n = \frac{1}{\sin c}$
Nuclear	
Radioactive alpha decay: ${}^{238}_{92}Th \rightarrow {}^{234}_{90}U + {}^{4}_{2}He + \mathit{energy}$	${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}Y + {}^{4}_{2}He$
Radioactive beta decay: ${}^{209}_{82}Pb \rightarrow {}^{209}_{83}Bi + {}^{0}_{-1}e + \text{energy}$	${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}e$
Radioactive gamma decay: ${}^{60}_{27}Co \rightarrow {}^{60}_{27}Co + \gamma + \text{energy}$	${}^{A}_{Z}X \rightarrow {}^{A}_{Z}Y + \gamma$
Energy *(J)* = mass defect *(kg)* × speed of light^2 *(ms^{-1})*	$E = mc^2$