



PHYSICS

STAGE 2

FORMULAE AND DATA

2012

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Forces and motion

Mean velocity	$v_{av} = \frac{s}{t} = \frac{v + u}{2}$
Equations of motion	$a = \frac{v - u}{t}$; $s = ut + \frac{1}{2} at^2$; $v^2 = u^2 + 2as$; $v = u + at$
Force	$F = ma$
Weight force	$F = mg$
Momentum	$p = mv$; $\Sigma p_{\text{before}} = \Sigma p_{\text{after}}$
Change in momentum (impulse)	$Ft = mv - mu$
Kinetic energy	$E_k = \frac{1}{2} mv^2$
Gravitational potential energy	$E_p = mgh$
Work done	$W = Fs = \Delta E$
Power	$P = \frac{W}{t} = \frac{\Delta E}{t} = Fv_{av}$

Note: the variable t refers to the 'time taken' sometimes referred to as the 'change in time' or Δt .

Nuclear physics

Activity	$A = \frac{\Delta N}{t}$
Half-life	$A = A_0 \left(\frac{1}{2}\right)^n$
Absorbed radiation dose	absorbed dose = $\frac{E}{m}$
Dose equivalent	dose equivalent = absorbed dose \times quality factor
Mass-energy relationship	$E = mc^2$

Heating and cooling

Change of temperature	$Q = mc\Delta T$
Change of state	$Q = mL$
Absolute zero	0 K = - 273°C

Electricity and magnetism

Electric current	$I = \frac{q}{t}$
Work and energy	$W = Vq = VIt$
Ohm's law	$V = IR$
Resistances in series	$R_T = R_1 + R_2 + \dots$
Resistances in parallel	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$
Power	$P = VI = I^2R = \frac{V^2}{R}$

Physical constants

Speed of light in vacuum or air	c	=	$3.00 \times 10^8 \text{ m s}^{-1}$
Electron charge	e	=	$-1.60 \times 10^{-19} \text{ C}$
Electron volt.....	1 eV	=	$1.60 \times 10^{-19} \text{ J}$
Unified atomic mass unit	1 u	=	$1.66 \times 10^{-27} \text{ kg}$
Rest mass of electron.....	m_e	=	$9.11 \times 10^{-31} \text{ kg}$
Rest mass of proton	m_p	=	$1.67 \times 10^{-27} \text{ kg}$
Rest mass of neutron	m_n	=	$1.67 \times 10^{-27} \text{ kg}$
Rest mass of alpha.....	m_α	=	$6.64 \times 10^{-27} \text{ kg}$
Mass–energy equivalent.....	1 u	=	931 MeV
Tonne.....	1 t	=	$10^3 \text{ kg} = 10^6 \text{ g}$

Physical data

Mean acceleration due to gravity on Earth.....	g	=	9.80 m s^{-2}
Specific heat capacity of water	c_w	=	$4.18 \times 10^3 \text{ J K}^{-1} \text{ kg}^{-1}$
Specific heat capacity of ice	c_i	=	$2.10 \times 10^3 \text{ J K}^{-1} \text{ kg}^{-1}$
Specific heat capacity of steam.....	c_s	=	$2.00 \times 10^3 \text{ J K}^{-1} \text{ kg}^{-1}$
Latent heat of fusion for H ₂ O	L_f	=	$3.34 \times 10^5 \text{ J kg}^{-1}$
Latent heat of vaporisation for H ₂ O.....	L_v	=	$2.26 \times 10^6 \text{ J kg}^{-1}$

Quality factors

Approximate quality factor for alpha radiation	QF_α	=	20
Approximate quality factor for beta radiation	QF_β	=	1
Approximate quality factor for gamma radiation...	QF_γ	=	1
Approximate quality factor for slow neutrons.....	QF_{sn}	=	3
Approximate quality factor for fast neutrons	QF_{fn}	=	10

Prefixes of the metric system

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10^{12}	tera	T	10^{-3}	milli	m
10^9	giga	G	10^{-6}	micro	μ
10^6	mega	M	10^{-9}	nano	n
10^3	kilo	k	10^{-12}	pico	p

Periodic table

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18													
1 H hydrogen 1.008	3 Li lithium 6.941	4 Be beryllium 9.012	12 Mg magnesium 24.31	19 K potassium 39.10	20 Ca calcium 40.08	21 Sc scandium 44.96	22 Ti titanium 47.88	23 V vanadium 50.94	24 Cr chromium 52.00	25 Mn manganese 54.94	26 Fe iron 55.85	27 Co cobalt 58.93	28 Ni nickel 58.69	29 Cu copper 63.55	30 Zn zinc 65.38	31 Ga gallium 69.72	32 Ge germanium 72.59	33 As arsenic 74.92	34 Se selenium 78.96	35 Br bromine 79.90	36 Kr krypton 83.80	54 Xe xenon 131.3								
11 Na sodium 22.99	12 Mg magnesium 24.31	13 Al aluminium 26.98	14 Si silicon 28.09	15 P phosphorus 30.97	16 S sulfur 32.06	17 Cl chlorine 35.45	18 Ar argon 39.95	37 Rb rubidium 85.47	38 Sr strontium 87.62	39 Y yttrium 88.91	40 Zr zirconium 91.22	41 Nb niobium 92.91	42 Mo molybdenum 95.94	43 Tc technetium	44 Ru ruthenium 101.1	45 Rh rhodium 102.9	46 Pd palladium 106.4	47 Ag silver 107.9	48 Cd cadmium 112.4	49 In indium 114.8	50 Sn tin 118.7	51 Sb antimony 121.8	52 Te tellurium 127.6	53 I iodine 126.9	81 Tl thallium 204.4	82 Pb lead 207.2	83 Bi bismuth 209.0	84 Po polonium	85 At astatine	86 Rn radon
55 Cs caesium 132.9	56 Ba barium 137.3	57-71 *La lanthanum 138.9	72 Hf hafnium 178.5	73 Ta tantalum 180.9	74 W tungsten 183.9	75 Re rhenium 186.2	76 Os osmium 190.2	77 Ir iridium 192.2	78 Pt platinum 195.1	79 Au gold 197.0	80 Hg mercury 200.6	81 Tl thallium 204.4	82 Pb lead 207.2	83 Bi bismuth 209.0	84 Po polonium	85 At astatine	86 Rn radon	87 Fr francium	88 Ra radium 226.0	89-103 **Ac actinium	104 Rf rutherfordium	105 Db dubnium	106 Sg seaborgium	107 Bh bohrium	108 Hs hassium	109 Mt meitnerium	110 Ds darmstadtium	111 Rg roentgenium	112 Cn copernicium	

Key:

Atomic number
Symbol
Name
Standard atomic weight

* Lanthanide series	58 Ce cerium 140.1	59 Pr praseodymium 140.9	60 Nd neodymium 144.2	61 Pm promethium	62 Sm samarium 150.4	63 Eu europium 152.0	64 Gd gadolinium 157.3	65 Tb terbium 158.9	66 Dy dysprosium 162.5	67 Ho holmium 164.9	68 Er erbium 167.3	69 Tm thulium 168.9	70 Yb ytterbium 173.0	71 Lu lutetium 175.0
** Actinide series	90 Th thorium 232.0	91 Pa protactinium	92 U uranium 238.0	93 Np neptunium	94 Pu plutonium	95 Am americium	96 Cm curium	97 Bk berkelium	98 Cf californium	99 Es einsteinium	100 Fm fermium	101 Md mendelevium	102 No nobelium	103 Lr lawrencium