



National
Qualifications
2025

X857/76/22

**Physics
Paper 1 — Relationships sheet**

THURSDAY, 15 MAY

9:00 AM – 9:45 AM



* X 8 5 7 7 6 2 2 *

Relationships required for Physics Higher

$$d = \bar{v}t$$

$$s = \bar{v}t$$

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

$$s = \frac{1}{2}(u + v)t$$

$$F = ma$$

$$W = mg$$

$$E_w = Fd, \text{ or } W = Fd$$

$$E_p = mgh$$

$$E_k = \frac{1}{2}mv^2$$

$$P = \frac{E}{t}$$

$$p = mv$$

$$Ft = mv - mu$$

$$F = G \frac{m_1 m_2}{r^2}$$

$$t' = \frac{t}{\sqrt{1 - \left(\frac{v}{c}\right)^2}}$$

$$l' = l \sqrt{1 - \left(\frac{v}{c}\right)^2}$$

$$f_o = f_s \left(\frac{v}{v \pm v_s} \right)$$

$$z = \frac{\lambda_{\text{observed}} - \lambda_{\text{rest}}}{\lambda_{\text{rest}}}$$

$$z = \frac{v}{c}$$

$$v = H_0 d$$

$$W = QV$$

$$E = mc^2$$

$$I = \frac{P}{A}$$

$$I = \frac{k}{d^2}$$

$$I_1 d_1^2 = I_2 d_2^2$$

$$E = hf$$

$$E_k = hf - hf_0$$

$$v = f\lambda$$

$$E_2 - E_1 = hf$$

$$d \sin \theta = m\lambda$$

$$n = \frac{\sin \theta_1}{\sin \theta_2}$$

$$\frac{\sin \theta_1}{\sin \theta_2} = \frac{\lambda_1}{\lambda_2} = \frac{v_1}{v_2}$$

$$\sin \theta_c = \frac{1}{n}$$

$$V_{rms} = \frac{V_{peak}}{\sqrt{2}}$$

$$I_{rms} = \frac{I_{peak}}{\sqrt{2}}$$

$$T = \frac{1}{f}$$

$$V = IR$$

$$P = IV = I^2 R = \frac{V^2}{R}$$

$$R_T = R_1 + R_2 + \dots$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

$$V_1 = \left(\frac{R_1}{R_1 + R_2} \right) V_S$$

$$\frac{V_1}{V_2} = \frac{R_1}{R_2}$$

$$E = V + Ir$$

$$C = \frac{Q}{V}$$

$$Q = It$$

$$E = \frac{1}{2} QV = \frac{1}{2} CV^2 = \frac{1}{2} \frac{Q^2}{C}$$

$$\text{path difference} = m\lambda \text{ or } \left(m + \frac{1}{2}\right)\lambda \text{ where } m = 0, 1, 2, \dots$$

$$\text{random uncertainty} = \frac{\text{max. value} - \text{min. value}}{\text{number of values}}$$

or

$$\Delta R = \frac{R_{\text{max}} - R_{\text{min}}}{n}$$

Additional relationships

Circle

$$\text{circumference} = 2\pi r$$

$$\text{area} = \pi r^2$$

Sphere

$$\text{area} = 4\pi r^2$$

$$\text{volume} = \frac{4}{3}\pi r^3$$

Trigonometry

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

Electron arrangements of elements

Group 1 Group 2
(1)

1	H	4	Be
Hydrogen	1	(2)	
3	Li	2,1	B
Lithium	2,1	2,2	Be
11	Na	12	Mg
2,8,1	2,8,1	2,8,2	2,8,2
Sodium	2,8,1	2,8,2	2,8,2
19	K	20	Ca
2,8,8,1	2,8,8,1	2,8,8,2	2,8,8,2
Potassium	2,8,8,1	2,8,8,2	2,8,8,2
37	Rb	38	Sr
2,8,18,8,1	2,8,18,8,1	2,8,18,8,2	2,8,18,8,2
Rubidium	2,8,18,8,1	2,8,18,8,2	2,8,18,8,2
55	Cs	56	Ba
2,8,18,18,8,1	2,8,18,18,8,1	2,8,18,18,8,2	2,8,18,18,8,2
Caesium	2,8,18,18,8,1	2,8,18,18,8,2	2,8,18,18,8,2
87	Fr	88	Ra
2,8,18,32,18,8,1	2,8,18,32,18,8,1	2,8,18,32,18,8,2	2,8,18,32,18,8,2
Francium	2,8,18,32,18,8,1	2,8,18,32,18,8,2	2,8,18,32,18,8,2

Key

Atomic number
Symbol
Electron arrangement
Name

Transition elements

21	Sc	22	Ti	23	V	24	Cr	25	Mn	26	Fe	27	Co	28	Ni	29	Cu	30	Zn
Scandium	2,8,9,2	Titanium	2,8,10,2	Vanadium	2,8,11,2	Chromium	2,8,13,1	Manganese	2,8,13,2	Iron	2,8,14,2	Cobalt	2,8,15,2	Nickel	2,8,16,2	Copper	2,8,18,1	Zinc	2,8,18,2
39	Y	40	Zr	41	Nb	42	Mo	43	Tc	44	Ru	45	Rh	46	Pd	47	Ag	48	Cd
Yttrium	2,8,18,9,2	Zirconium	2,8,18,10,2	Niobium	2,8,18,12,1	Molybdenum	2,8,18,13,1	Technetium	2,8,18,13,2	Ruthenium	2,8,18,15,1	Rhodium	2,8,18,16,1	Palladium	2,8,18,18,0	Silver	2,8,18,18,1	Cadmium	2,8,18,18,2
57	La	72	Hf	73	Ta	74	W	75	Re	76	Os	77	Ir	78	Pt	79	Au	80	Hg
Lanthanum	2,8,18,18,9,2	Hafnium	2,8,18,32,10,2	Tantalum	2,8,18,32,11,2	Tungsten	2,8,18,32,12,2	Rhenium	2,8,18,32,13,2	Osmium	2,8,18,32,14,2	Iridium	2,8,18,32,15,2	Platinum	2,8,18,32,17,1	Gold	2,8,18,32,18,1	Mercury	2,8,18,32,18,2
89	Ac	104	Rf	105	Db	106	Sg	107	Bh	108	Hs	109	Mt	110	Ds	111	Rg	112	Cn
Actinium	2,8,18,32,18,9,2	Rutherfordium	2,8,18,32,32,10,2	Dubnium	2,8,18,32,32,11,2	Seaborgium	2,8,18,32,32,12,2	Bohrium	2,8,18,32,32,13,2	Hassium	2,8,18,32,32,14,2	Meitnerium	2,8,18,32,32,15,2	Darmstadtium	2,8,18,32,32,17,1	Roentgenium	2,8,18,32,32,18,1	Copernicium	2,8,18,32,32,18,2

Lanthanides

57	La	58	Ce	59	Pr	60	Nd	61	Pm	62	Sm	63	Eu	64	Gd	65	Tb	66	Dy	67	Ho	68	Er	69	Tm	70	Yb	71	Lu
Lanthanum	2,8,18,18,9,2	Cerium	2,8,18,20,8,2	Praseodymium	2,8,18,21,8,2	Neodymium	2,8,18,22,8,2	Promethium	2,8,18,23,8,2	Samarium	2,8,18,24,8,2	Europium	2,8,18,25,8,2	Gadolinium	2,8,18,25,9,2	Terbium	2,8,18,27,8,2	Dysprosium	2,8,18,28,8,2	Holmium	2,8,18,29,8,2	Erbium	2,8,18,30,8,2	Thulium	2,8,18,31,8,2	Ytterbium	2,8,18,32,8,2	Lutetium	2,8,18,32,9,2

Actinides

89	Ac	90	Th	91	Pa	92	U	93	Np	94	Pu	95	Am	96	Cm	97	Bk	98	Cf	99	Es	100	Fm	101	Md	102	No	103	Lr
Actinium	2,8,18,32,18,9,2	Thorium	2,8,18,32,18,10,2	Protactinium	2,8,18,32,20,9,2	Uranium	2,8,18,32,21,9,2	Neptunium	2,8,18,32,22,9,2	Plutonium	2,8,18,32,24,8,2	Americium	2,8,18,32,25,8,2	Curium	2,8,18,32,25,9,2	Berkelium	2,8,18,32,27,8,2	Californium	2,8,18,32,28,8,2	Einsteinium	2,8,18,32,29,8,2	Fermium	2,8,18,32,30,8,2	Mendelevium	2,8,18,32,31,8,2	Nobelium	2,8,18,32,32,8,2	Lawrencium	2,8,18,32,32,9,2

Group 3 Group 4 Group 5 Group 6 Group 7 Group 8 Group 9 Group 10 Group 11 Group 12
(18)

5	B	6	C	7	N	8	O	9	F	10	Ne
2,3	2,3	2,4	2,5	2,6	2,7	2,8	2,8	2,8,8	2,8,8	2,8,8	2,8,8
Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon						
13	Al	14	Si	15	P	16	S	17	Cl	18	Ar
2,8,3	2,8,3	2,8,4	2,8,5	2,8,6	2,8,7	2,8,8	2,8,8	2,8,8	2,8,8	2,8,8	2,8,8
Aluminium	Silicon	Phosphorus	Sulfur	Chlorine	Argon						
31	Ga	32	Ge	33	As	34	Se	35	Br	36	Kr
2,8,18,3	2,8,18,3	2,8,18,4	2,8,18,5	2,8,18,5	2,8,18,6	2,8,18,6	2,8,18,7	2,8,18,7	2,8,18,8	2,8,18,8	2,8,18,8
Gallium	Germanium	Arsenic	Selenium	Bromine	Krypton						
49	In	50	Sn	51	Sb	52	Te	53	I	54	Xe
2,8,18,18,3	2,8,18,18,3	2,8,18,18,4	2,8,18,18,4	2,8,18,18,5	2,8,18,18,5	2,8,18,18,6	2,8,18,18,6	2,8,18,18,7	2,8,18,18,7	2,8,18,18,8	2,8,18,18,8
Indium	Tin	Antimony	Tellurium	Iodine	Xenon						
81	Tl	82	Pb	83	Bi	84	Po	85	At	86	Rn
2,8,18,32,18,3	2,8,18,32,18,3	2,8,18,32,18,4	2,8,18,32,18,5	2,8,18,32,18,5	2,8,18,32,18,6	2,8,18,32,18,6	2,8,18,32,18,7	2,8,18,32,18,7	2,8,18,32,18,8	2,8,18,32,18,8	2,8,18,32,18,8
Thallium	Lead	Bismuth	Polonium	Astatine	Radon						