



National
Qualifications
2024

X857/76/22

Physics
Paper 1 — Relationships sheet

THURSDAY, 25 APRIL

9:00 AM – 9:45 AM



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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 Hydrogen	4 Be 2.2 Beryllium
3 Li 2.1 Lithium	12 Mg 2.8, 2 Magnesium
11 Na 2.8, 1	20 Ca 2.8, 8, 2 Calcium
19 K 2.8, 8, 1	38 Sr 2.8, 18, 8, 2 Strontium
37 Rb 2.8, 18, 8, 1	56 Ba 2.8, 18, 18, 8, 2 Barium
Rubidium	Caesium
55 Cs 2.8, 18, 18, 8, 1	88 Ra 2.8, 18, 32, 18, 8, 2 Radium

Key

Atomic number
Symbol
Electron arrangement
Name

Transition elements

21 Sc 2.8, 9, 2	22 Ti 2.8, 10, 2	23 V 2.8, 11, 2	24 Cr 2.8, 13, 1	25 Mn 2.8, 13, 2	26 Fe 2.8, 14, 2	27 Co 2.8, 15, 2	28 Ni 2.8, 16, 2	29 Cu 2.8, 18, 1	30 Zn 2.8, 18, 2
39 Y 2.8, 18, 9, 2	40 Zr 2.8, 18, 10, 2	41 Nb 2.8, 18, 12, 1	42 Mo 2.8, 18, 13, 1	43 Tc 2.8, 18, 13, 2	44 Ru 2.8, 18, 15, 1	45 Rh 2.8, 18, 16, 1	46 Pd 2.8, 18, 18, 0	47 Ag 2.8, 18, 18, 1	48 Cd 2.8, 18, 18, 2
57 La 2.8, 18, 18, 9, 2	72 Hf 2.8, 18, 32, 10, 2	73 Ta 2.8, 18, 32, 11, 2	74 W 2.8, 18, 32, 12, 2	75 Re 2.8, 18, 32, 13, 2	76 Os 2.8, 18, 32, 14, 2	77 Ir 2.8, 18, 32, 15, 2	78 Pt 2.8, 18, 32, 17, 1	79 Au 2.8, 18, 32, 18, 1	80 Hg 2.8, 18, 32, 18, 2
Lanthanum	Hafnium	Tantalum	Tungsten	Rhenium	Osmium	Iridium	Platinum	Gold	Mercury
89 Ac 2.8, 18, 32, 18, 9, 2	104 Rf 2.8, 18, 32, 32, 10, 2	105 Db 2.8, 18, 32, 32, 11, 2	106 Sg 2.8, 18, 32, 32, 12, 2	107 Bh 2.8, 18, 32, 32, 13, 2	108 Hs 2.8, 18, 32, 32, 14, 2	109 Mt 2.8, 18, 32, 32, 15, 2	110 Ds 2.8, 18, 32, 32, 17, 1	111 Rg 2.8, 18, 32, 32, 18, 1	112 Cn 2.8, 18, 32, 32, 18, 2
Actinium	Rutherfordium	Dubnium	Seaborgium	Bohrium	Hassium	Meitnerium	Darmstadtium	Koerngenium	Copernicium

Group 3 Group 4 Group 5 Group 6 Group 7 Group 0
(18)

5 B 2.3 Boron	6 C 2.4 Carbon	7 N 2.5 Nitrogen	8 O 2.6 Oxygen	9 F 2.7 Fluorine	10 Ne 2.8 Neon
13 Al 2.8, 3	14 Si 2.8, 4	15 P 2.8, 5	16 S 2.8, 6	17 Cl 2.8, 7	18 Ar 2.8, 8
Aluminium	Silicon	Phosphorus	Sulfur	Chlorine	Argon
31 Ga 2.8, 18, 3	32 Ge 2.8, 18, 4	33 As 2.8, 18, 5	34 Se 2.8, 18, 6	35 Br 2.8, 18, 7	36 Kr 2.8, 18, 8
Gallium	Germanium	Arsenic	Selenium	Bromine	Krypton
49 In 2.8, 18, 18, 3	50 Sn 2.8, 18, 18, 4	51 Sb 2.8, 18, 18, 5	52 Te 2.8, 18, 18, 6	53 I 2.8, 18, 18, 7	54 Xe 2.8, 18, 18, 8
Indium	Tin	Antimony	Tellurium	Iodine	Xenon
81 Tl 2.8, 18, 32, 18, 3	82 Pb 2.8, 18, 32, 18, 4	83 Bi 2.8, 18, 32, 18, 5	84 Po 2.8, 18, 32, 18, 6	85 At 2.8, 18, 32, 18, 7	86 Rn 2.8, 18, 32, 18, 8
Thallium	Lead	Bismuth	Polonium	Astatine	Radon

Lanthanides

57 La 2.8, 18, 18, 9, 2 Lanthanum	58 Ce 2.8, 18, 20, 8, 2 Cerium	59 Pr 2.8, 18, 21, 8, 2 Praseodymium	60 Nd 2.8, 18, 22, 8, 2 Neodymium	61 Pm 2.8, 18, 23, 8, 2 Promethium	62 Sm 2.8, 18, 24, 8, 2 Samarium	63 Eu 2.8, 18, 25, 8, 2 Europium	64 Gd 2.8, 18, 25, 9, 2 Gadolinium	65 Tb 2.8, 18, 27, 8, 2 Terbium	66 Dy 2.8, 18, 28, 8, 2 Dysprosium	67 Ho 2.8, 18, 29, 8, 2 Holmium	68 Er 2.8, 18, 30, 8, 2 Erbium	69 Tm 2.8, 18, 31, 8, 2 Thulium	70 Yb 2.8, 18, 32, 8, 2 Ytterbium	71 Lu 2.8, 18, 32, 9, 2 Lutetium
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Actinides

89 Ac 2.8, 18, 32, 18, 9, 2 Actinium	90 Th 2.8, 18, 32, 18, 10, 2 Thorium	91 Pa 2.8, 18, 32, 20, 9, 2 Protactinium	92 U 2.8, 18, 32, 21, 9, 2 Uranium	93 Np 2.8, 18, 32, 22, 9, 2 Neptunium	94 Pu 2.8, 18, 32, 24, 8, 2 Plutonium	95 Am 2.8, 18, 32, 25, 8, 2 Americium	96 Cm 2.8, 18, 32, 25, 9, 2 Curium	97 Bk 2.8, 18, 32, 27, 8, 2 Berkelium	98 Cf 2.8, 18, 32, 28, 8, 2 Californium	99 Es 2.8, 18, 32, 29, 8, 2 Einsteinium	100 Fm 2.8, 18, 32, 30, 8, 2 Fermium	101 Md 2.8, 18, 32, 31, 8, 2 Mendelevium	102 No 2.8, 18, 32, 32, 8, 2 Nobelium	103 Lr 2.8, 18, 32, 32, 9, 2 Lawrencium
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