



National
Qualifications
2018

X757/76/11

**Physics
Relationships Sheet**

TUESDAY, 8 MAY
9:00 AM – 11:30 AM



Relationships required for Physics Higher

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

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

$$v = u + at$$

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

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

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

$$W = mg$$

$$F = ma$$

$$E_w = Fd$$

$$E_p = mgh$$

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

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

$$p = mv$$

$$Ft = mv - mu$$

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

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

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

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

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

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

$$v = H_0 d$$

$$W = QV$$

$$E = mc^2$$

$$E = hf$$

$$E_k = hf - hf_0$$

$$E_2 - E_1 = hf$$

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

$$v = f\lambda$$

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

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

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

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

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

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

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

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

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

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

$$Q = It$$

$$V = IR$$

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

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

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

$$E = V + Ir$$

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

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

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

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

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 Beryllium
1	(2)
3 Li Lithium	2,2
11 Na Sodium	2,8,1
19 K Potassium	2,8,8,1
21 Sc Scandium	2,8,9,2
23 V Vanadium	2,8,11,2
25 Mn Manganese	2,8,13,2
27 Co Cobalt	2,8,15,2
29 Cu Copper	2,8,18,1
30 Zn Zinc	2,8,18,2
31 Ga Gallium	2,8,18,3
32 Ge Germanium	2,8,18,4
33 As Arsenic	2,8,18,5
34 Se Selenium	2,8,18,6
35 Br Bromine	2,8,18,7
36 Kr Krypton	2,8,18,8
37 Rb Rubidium	2,8,18,8,1
38 Sr Strontium	2,8,18,8,2
39 Y Yttrium	2,8,18,9,2
40 Zr Zirconium	2,8,18,10,2
41 Nb Niobium	2,8,18,12,1
42 Mo Molybdenum	2,8,18,13,1
43 Tc Technetium	2,8,18,13,2
44 Ru Ruthenium	2,8,18,15,1
45 Rh Rhodium	2,8,18,16,1
46 Pd Palladium	2,8,18,18,0
47 Ag Silver	2,8,18,18,1
48 Cd Cadmium	2,8,18,18,2
49 In Indium	2,8,18,18,3
50 Sn Tin	2,8,18,18,4
51 Sb Antimony	2,8,18,18,5
52 Te Tellurium	2,8,18,18,6
53 I Iodine	2,8,18,18,7
54 Xe Xenon	2,8,18,18,8
55 Cs Caesium	2,8,18,18,8,1
56 Ba Barium	2,8,18,18,8,2
57 La Lanthanum	2,8,18,18,9,2
58 Ce Cerium	2,8,18,18,9,2
59 Pr Praseodymium	2,8,18,18,9,2
60 Nd Neodymium	2,8,18,18,9,2
61 Pm Promethium	2,8,18,18,9,2
62 Sm Samarium	2,8,18,18,9,2
63 Eu Europium	2,8,18,18,9,2
64 Gd Gadolinium	2,8,18,18,9,2
65 Tb Terbium	2,8,18,18,9,2
66 Dy Dysprosium	2,8,18,18,9,2
67 Ho Holmium	2,8,18,18,9,2
68 Er Erbium	2,8,18,18,9,2
69 Tm Thulium	2,8,18,18,9,2
70 Yb Ytterbium	2,8,18,18,9,2
71 Lu Lutetium	2,8,18,18,9,2
72 Hf Hafnium	2,8,18,18,32,10,2
73 Ta Tantalum	2,8,18,32,11,2
74 W Tungsten	2,8,18,32,12,2
75 Re Rhenium	2,8,18,32,13,2
76 Os Osmium	2,8,18,32,14,2
77 Ir Iridium	2,8,18,32,15,2
78 Pt Platinum	2,8,18,32,17,1
79 Au Gold	2,8,18,32,18,1
80 Hg Mercury	2,8,18,32,18,2
81 Tl Thallium	2,8,18,32,18,3
82 Pb Lead	2,8,18,32,18,4
83 Bi Bismuth	2,8,18,32,18,5
84 Po Polonium	2,8,18,32,18,6
85 At Astatine	2,8,18,32,18,7
86 Rn Radon	2,8,18,32,18,8
87 Fr Francium	2,8,18,32,18,8,1
88 Ra Radium	2,8,18,32,18,8,2
89 Ac Actinium	2,8,18,32,32,10,2
104 Rf Rutherfordium	2,8,18,32,32,10,2
105 Db Dubnium	2,8,18,32,32,11,2
106 Sg Seaborgium	2,8,18,32,32,12,2
107 Bh Bohrium	2,8,18,32,32,13,2
108 Hs Hassium	2,8,18,32,32,14,2
109 Mt Meitnerium	2,8,18,32,32,15,2
110 Ds Darmstadtium	2,8,18,32,32,17,1
111 Rg Roentgenium	2,8,18,32,32,18,1
112 Cn Copernicium	2,8,18,32,32,18,2

Key

Atomic number
Symbol
Electron arrangement
Name

Transition Elements

21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc
(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

Group 3 Group 4 Group 5 Group 6 Group 7 Group 8
(18)

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

Lanthanides

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

Actinides

89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	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
2,8,18,32,18,9,2	2,8,18,32,18,10,2	2,8,18,32,20,9,2	2,8,18,32,21,9,2	2,8,18,32,22,9,2	2,8,18,32,24,8,2	2,8,18,32,25,8,2	2,8,18,32,25,9,2	2,8,18,32,27,8,2	2,8,18,32,28,8,2	2,8,18,32,29,8,2	2,8,18,32,30,8,2	2,8,18,32,31,8,2	2,8,18,32,32,8,2	2,8,18,32,32,9,2