



National  
Qualifications  
2016

**X757/76/11**

**Physics  
Relationships Sheet**

TUESDAY, 24 MAY  
9:00 AM – 11:30 AM



\* X 7 5 7 7 6 1 1 \*

## 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	<b>H</b>	4	<b>Be</b>
Hydrogen	1	(2)	
3	<b>Li</b>	2,1	<b>B</b>
Lithium	2,1	2,2	Beryllium
11	<b>Na</b>	12	<b>Mg</b>
2,8,1	2,8,1	2,8,2	
Sodium		Magnessium	
19	<b>K</b>	20	<b>Ca</b>
2,8,8,1	2,8,8,1	2,8,8,2	Calcium
Potassium			
37	<b>Rb</b>	38	<b>Sr</b>
2,8,18,8,1	2,8,18,8,1	2,8,18,8,2	Strontium
Rubidium			
55	<b>Cs</b>	56	<b>Ba</b>
2,8,18,18,8,1	2,8,18,18,8,1	2,8,18,18,8,2	Barium
Caesium			
87	<b>Fr</b>	88	<b>Ra</b>
2,8,18,32,18,8,1	2,8,18,32,18,8,1	2,8,18,32,18,8,2	Radium
Francium			

### Key

Atomic number
Symbol
Electron arrangement
Name

### Transition Elements

21	<b>Sc</b>	22	<b>Ti</b>	23	<b>V</b>	24	<b>Cr</b>	25	<b>Mn</b>	26	<b>Fe</b>	27	<b>Co</b>	28	<b>Ni</b>	29	<b>Cu</b>	30	<b>Zn</b>
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	<b>Y</b>	40	<b>Zr</b>	41	<b>Nb</b>	42	<b>Mo</b>	43	<b>Tc</b>	44	<b>Ru</b>	45	<b>Rh</b>	46	<b>Pd</b>	47	<b>Ag</b>	48	<b>Cd</b>
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	<b>La</b>	72	<b>Hf</b>	73	<b>Ta</b>	74	<b>W</b>	75	<b>Re</b>	76	<b>Os</b>	77	<b>Ir</b>	78	<b>Pt</b>	79	<b>Au</b>	80	<b>Hg</b>
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	<b>Ac</b>	104	<b>Rf</b>	105	<b>Db</b>	106	<b>Sg</b>	107	<b>Bh</b>	108	<b>Hs</b>	109	<b>Mt</b>	110	<b>Ds</b>	111	<b>Rg</b>	112	<b>Cn</b>
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	<b>La</b>	58	<b>Ce</b>	59	<b>Pr</b>	60	<b>Nd</b>	61	<b>Pm</b>	62	<b>Sm</b>	63	<b>Eu</b>	64	<b>Gd</b>	65	<b>Tb</b>	66	<b>Dy</b>	67	<b>Ho</b>	68	<b>Er</b>	69	<b>Tm</b>	70	<b>Yb</b>	71	<b>Lu</b>
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	<b>Ac</b>	90	<b>Th</b>	91	<b>Pa</b>	92	<b>U</b>	93	<b>Np</b>	94	<b>Pu</b>	95	<b>Am</b>	96	<b>Cm</b>	97	<b>Bk</b>	98	<b>Cf</b>	99	<b>Es</b>	100	<b>Fm</b>	101	<b>Md</b>	102	<b>No</b>	103	<b>Lr</b>
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>B</b>	6	<b>C</b>	7	<b>N</b>	8	<b>O</b>	9	<b>F</b>	10	<b>Ne</b>
2,3	2,4	2,5	2,6	2,7	2,8					Helium	2
Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon						
13	<b>Al</b>	14	<b>Si</b>	15	<b>P</b>	16	<b>S</b>	17	<b>Cl</b>	18	<b>Ar</b>
2,8,3	2,8,3	2,8,4	2,8,5	2,8,6	2,8,7	2,8,8				Argon	2,8,8
Aluminium	Silicon	Phosphorus	Sulfur	Chlorine	Argon						
31	<b>Ga</b>	32	<b>Ge</b>	33	<b>As</b>	34	<b>Se</b>	35	<b>Br</b>	36	<b>Kr</b>
2,8,18,3	2,8,18,3	2,8,18,4	2,8,18,5	2,8,18,6	2,8,18,7	2,8,18,8				Krypton	2,8,18,8
Gallium	Germanium	Arsenic	Selenium	Bromine							
49	<b>In</b>	50	<b>Sn</b>	51	<b>Sb</b>	52	<b>Te</b>	53	<b>I</b>	54	<b>Xe</b>
2,8,18,18,3	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				Xenon	2,8,18,18,8
Indium	Tin	Antimony	Tellurium	Iodine							
81	<b>Tl</b>	82	<b>Pb</b>	83	<b>Bi</b>	84	<b>Po</b>	85	<b>At</b>	86	<b>Rn</b>
2,8,18,32,18,3	2,8,18,32,18,3	2,8,18,32,18,4	2,8,18,32,18,5	2,8,18,32,18,6	2,8,18,32,18,7	2,8,18,32,18,8				Radon	2,8,18,32,18,8
Thallium	Lead	Bismuth	Polonium	Astatine							