



National  
Qualifications  
2019

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**X857/75/11**

**Physics  
Relationships sheet**

WEDNESDAY, 15 MAY

1:00 PM – 3:30 PM

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\* X 8 5 7 7 5 1 1 \*

$$d = vt$$

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

$$s = vt$$

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

$$a = \frac{v-u}{t}$$

$$F = ma$$

$$W = mg$$

$$E_w = Fd$$

$$E_p = mgh$$

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

$$Q = It$$

$$V = IR$$

$$V_2 = \left( \frac{R_2}{R_1 + R_2} \right) V_s$$

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

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

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

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

$$P = IV$$

$$P = I^2R$$

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

$$E_h = cm\Delta T$$

$$E_h = ml$$

$$p = \frac{F}{A}$$

$$p_1V_1 = p_2V_2$$

$$\frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{pV}{T} = \text{constant}$$

$$f = \frac{N}{t}$$

$$v = f\lambda$$

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

$$A = \frac{N}{t}$$

$$D = \frac{E}{m}$$

$$H = Dw_r$$

$$\dot{H} = \frac{H}{t}$$

# 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	<b>Be</b>
11	<b>Na</b>	12	<b>Mg</b>
2,8,1	2,8,1	2,8,2	2,8,2
Sodium	2,8,1	2,8,2	2,8,2
19	<b>K</b>	20	<b>Ca</b>
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	<b>Rb</b>	38	<b>Sr</b>
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	<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	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	<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	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
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### 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

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	2,3	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	<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	2,8,8	2,8,7	2,8,8	2,8,8	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	2,8,18,5	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	<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	2,8,18,18,4	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	<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	2,8,18,32,18,5	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						

### 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>
2,8,18,18,9,2	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	2,8,18,26,8,2	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	2,8,18,32,8,2	2,8,18,32,8,2	2,8,18,32,8,2	2,8,18,32,8,2	2,8,18,32,8,2	2,8,18,32,8,2	2,8,18,32,8,2	2,8,18,32,8,2	2,8,18,32,8,2	2,8,18,32,8,2	2,8,18,32,8,2	2,8,18,32,8,2	2,8,18,32,8,2	2,8,18,32,8,2	
Lanthanum	Cerium	Praseodymium	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium	Lutetium															

### 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>
2,8,18,32,18,9,2	2,8,18,32,18,9,2	2,8,18,32,18,10,2	2,8,18,32,18,10,2	2,8,18,32,20,9,2	2,8,18,32,20,9,2	2,8,18,32,21,9,2	2,8,18,32,22,9,2	2,8,18,32,22,9,2	2,8,18,32,24,8,2	2,8,18,32,24,8,2	2,8,18,32,25,8,2	2,8,18,32,25,8,2	2,8,18,32,27,8,2	2,8,18,32,27,8,2	2,8,18,32,28,8,2	2,8,18,32,28,8,2	2,8,18,32,29,8,2	2,8,18,32,29,8,2	2,8,18,32,30,8,2	2,8,18,32,30,8,2	2,8,18,32,31,8,2	2,8,18,32,31,8,2	2,8,18,32,32,8,2	2,8,18,32,32,8,2	2,8,18,32,32,8,2	2,8,18,32,32,8,2	2,8,18,32,32,8,2	2,8,18,32,32,8,2	
Actinium	Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium	Lawrencium															