National Qualifications

**AH**

# S857/77/11 Physics

**Relationships sheet**

Date — Not applicable Duration — 3 hours



©

## \*Thanks to N Douglas\*

|  |  |  |
| --- | --- | --- |
| **Relationships Required for Advanced Higher Physics** | | |
|  |  |
| or  or where |  | |

##### Additional relationships

**Circle** circumference  2*πr* area  *πr*2

##### Sphere

area  4*πr*2

volume  4 *πr*3

3

##### Table of standard derivatives

|  |  |
| --- | --- |
| *f* (*x*) | *f* (*x*) |
| sin *ax* | *a* cos *ax* |
| cos *ax* | *a* sin *ax* |

**Trigonometry Table of standard integrals**

sin *θ* 

cos *θ* 

opposite hypotenuse

adjacent hypotenuse

|  |  |
| --- | --- |
| *f* (*x*) |  *f* (*x*)*dx* |
| sin *ax* | * 1 cos *ax*  *C a* |
| cos *ax* | 1 sin *ax*  *C a* |

tan *θ*  opposite

adjacent

sin2 *θ*  cos2 *θ*  1

##### Moment of inertia

point mass

*I*  *mr*2

rod about centre

*I*  1 *ml*2

12

rod about end

*I*  1 *ml*2

3

disc about centre

*I*  1 *mr*2

2

sphere about centre

*I*  2 *mr*2

5

##### Electron arrangements of elements

*page 05*

**Group 1 Group 2 Group 3 Group 4 Group 5 Group 6 Group 7 Group 0**

(1) (18)

##### Key

Atomic number Symbol

Electron arrangement Name

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| (13) | (14) | (15) | (16) | (17) | 2  **He**  2  Helium |
| 5  **B** | 6  **C** | 7  **N** | 8  **O** | 9  **F** | 10  **Ne** |
| 2,3 | 2,4 | 2,5 | 2,6 | 2,7 | 2,8 |
| Boron | Carbon | Nitrogen | Oxygen | Fluorine | Neon |
| 13  **Al** | 14  **Si** | 15  **P** | 16  **S** | 17  **Cl** | 18  **Ar** |
| 2,8,3 | 2,8,4 | 2,8,5 | 2,8,6 | 2,8,7 | 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 | 2,8,18,4 | 2,8,18,5 | 2,8,18,6 | 2,8,18,7 | 2,8,18,8 |
| Gallium | Germanium | Arsenic | Selenium | Bromine | Krypton |
| 49 | 50 | 51 | 52 | 53 | 54 |
| **In** | **Sn** | **Sb** | **Te** | **I** | **Xe** |
| 2,8,18, | 2,8,18, | 2,8,18, | 2,8,18, | 2,8,18, | 2,8,18, |
| 18,3 | 18,4 | 18,5 | 18,6 | 18,7 | 18,8 |
| Indium | Tin | Antimony | Tellurium | Iodine | Xenon |
| 81 | 82 | 83 | 84 | 85 | 86 |
| **Tl** | **Pb** | **Bi** | **Po** | **At** | **Rn** |
| 2,8,18, | 2,8,18, | 2,8,18, | 2,8,18, | 2,8,18, | 2,8,18, |
| 32,18,3 | 32,18,4 | 32,18,5 | 32,18,6 | 32,18,7 | 32,18,8 |
| Thallium | Lead | Bismuth | Polonium | Astatine | Radon |

**Transition elements**

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

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

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

**Lanthanides**

**Actinides**