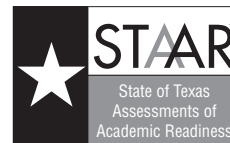


STAAR PHYSICS REFERENCE MATERIALS



FORCE AND MOTION

$$\text{Average velocity} = \frac{\text{displacement}}{\text{change in time}}$$

$$v_{\text{avg}} = \frac{\Delta d}{\Delta t}$$

$$\text{Acceleration} = \frac{\text{final velocity} - \text{initial velocity}}{\text{change in time}}$$

$$a = \frac{v_f - v_i}{\Delta t}$$

$$\text{Acceleration} = \frac{(\text{final velocity})^2 - (\text{initial velocity})^2}{2(\text{displacement})}$$

$$a = \frac{v_f^2 - v_i^2}{2\Delta d}$$

$$\text{Displacement} = \left(\text{initial velocity} \right) \left(\text{change in time} \right) + \frac{1}{2} (\text{acceleration}) \left(\text{change in time} \right)^2$$

$$\Delta d = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$\text{Centripetal acceleration} = \frac{(\text{tangential velocity})^2}{\text{radius}}$$

$$a_c = \frac{v_t^2}{r}$$

$$\text{Net force} = (\text{mass})(\text{acceleration})$$

$$F_{\text{net}} = ma$$

$$\text{Work} = (\text{force})(\text{distance})$$

$$W = Fd$$

$$\text{Torque} = (\text{force})(\text{lever arm})$$

$$\tau = Fr$$

$$\text{Power} = \frac{\text{work}}{\text{time}}$$

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

$$\text{Pythagorean theorem}$$

$$a^2 + b^2 = c^2$$

GRAVITATIONAL, ELECTRICAL, AND MAGNETIC FORCES

$$\text{Force of gravitational attraction between 2 objects} = \left(\text{universal gravitation constant} \right) \left(\frac{\left(\text{mass of 1st object} \right) \left(\text{mass of 2nd object} \right)}{\left(\text{distance between centers of objects} \right)^2} \right)$$

$$F_g = G \left(\frac{m_1 m_2}{d^2} \right)$$

$$\text{Force between 2 charged particles} = \left(\text{Coulomb's constant} \right) \left(\frac{\left(\text{charge of 1st particle} \right) \left(\text{charge of 2nd particle} \right)}{\left(\text{distance between particles} \right)^2} \right)$$

$$F_{\text{electric}} = k_c \left(\frac{q_1 q_2}{d^2} \right)$$

$$\text{Electrical power} = (\text{voltage})(\text{current})$$

$$P = VI$$

$$\text{Current} = \frac{\text{voltage}}{\text{resistance}}$$

$$I = \frac{V}{R}$$

$$\text{Equivalent resistance for resistors in series}$$

$$R = R_1 + R_2 + R_3 + \dots$$

$$\text{Equivalent resistance for resistors in parallel}$$

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

STAAR PHYSICS REFERENCE MATERIALS



ENERGY AND MOMENTUM

$$\text{Kinetic energy} = \frac{1}{2}(\text{mass})(\text{velocity})^2 \qquad KE = \frac{1}{2}mv^2$$

$$\text{Gravitational potential energy} = (\text{mass})\left(\frac{\text{acceleration}}{\text{due to gravity}}\right)(\text{height}) \qquad PE_g = mgh$$

$$\text{Elastic potential energy} = \frac{1}{2}\left(\frac{\text{spring}}{\text{constant}}\right)\left(\frac{\text{distance stretched}}{\text{or compressed}}\right)^2 \qquad PE_{\text{elastic}} = \frac{1}{2}kx^2$$

$$\text{Energy} = (\text{power})(\text{time}) \qquad E = Pt$$

$$\text{Work} = \text{change in kinetic energy} \qquad W = \Delta KE$$

$$\text{Mechanical energy} = \text{kinetic energy} + \text{potential energy} \qquad ME = KE + PE$$

$$\text{Law of conservation of energy} \qquad KE_i + PE_i = KE_f + PE_f$$

$$\text{Momentum} = (\text{mass})(\text{velocity}) \qquad p = mv$$

$$\text{Impulse} = (\text{force})(\text{change in time}) = (\text{mass})(\text{change in velocity}) \qquad J = F\Delta t = m\Delta v$$

$$\text{Law of conservation of momentum} \qquad m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$$

$$\text{Heat gained or lost} = (\text{mass})\left(\frac{\text{specific}}{\text{heat}}\right)\left(\frac{\text{change in}}{\text{temperature}}\right) \qquad Q = mc_p\Delta T$$

WAVES AND LIGHT

$$\text{Velocity} = (\text{frequency})(\text{wavelength}) \qquad v = f\lambda$$

$$\frac{1}{\text{Focal length}} = \frac{1}{\text{distance to image}} + \frac{1}{\text{distance to object}} \qquad \frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$$

$$\text{Energy} = (\text{mass})(\text{speed of light})^2 \qquad E = mc^2$$

STAAR PHYSICS REFERENCE MATERIALS



CONSTANTS AND CONVERSIONS

$$c = \text{speed of light} = 3.00 \times 10^8 \frac{\text{m}}{\text{s}}$$

$$g = \text{acceleration due to gravity} = 9.8 \frac{\text{m}}{\text{s}^2}$$

$$G = \text{universal gravitation constant} = 6.67 \times 10^{-11} \frac{\text{N} \cdot \text{m}^2}{\text{kg}^2}$$

$$k_C = \text{Coulomb's constant} = 8.99 \times 10^9 \frac{\text{N} \cdot \text{m}^2}{\text{C}^2}$$

$$m_E = \text{mass of Earth} = 5.97 \times 10^{24} \text{ kg}$$

$$r_E = \text{radius of Earth} = 6.37 \times 10^6 \text{ m}$$

$$\text{newton (N)} = \frac{\text{kg} \cdot \text{m}}{\text{s}^2}$$

$$\text{joule (J)} = \text{N} \cdot \text{m}$$

$$\text{watt (W)} = \frac{\text{J}}{\text{s}} = \frac{\text{N} \cdot \text{m}}{\text{s}}$$

$$\text{hertz (Hz)} = \frac{\text{cycle}}{\text{s}}$$

STAAR PHYSICS REFERENCE MATERIALS



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18														
1A	2A	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	3A	4A	5A	6A	7A	8A														
1 H 1.008 Hydrogen	2 He 4.003 Helium	3 Li 6.941 Lithium	4 Be 9.012 Beryllium	5 B 10.812 Boron	6 C 12.011 Carbon	7 N 14.007 Nitrogen	8 O 15.999 Oxygen	9 F 18.998 Fluorine	10 Ne 20.180 Neon	11 Na 22.990 Sodium	12 Mg 24.305 Magnesium	13 Al 26.982 Aluminum	14 Si 28.086 Silicon	15 P 30.974 Phosphorus	16 S 32.066 Sulfur	17 Cl 35.453 Chlorine	18 Ar 39.948 Argon														
19 K 39.098 Potassium	20 Ca 40.078 Calcium	21 Sc 44.956 Scandium	22 Ti 47.867 Titanium	23 V 50.942 Vanadium	24 Cr 51.996 Chromium	25 Mn 54.938 Manganese	26 Fe 55.845 Iron	27 Co 58.933 Cobalt	28 Ni 58.693 Nickel	29 Cu 63.546 Copper	30 Zn 65.38 Zinc	31 Ga 69.723 Gallium	32 Ge 72.64 Germanium	33 As 74.922 Arsenic	34 Se 78.96 Selenium	35 Br 79.904 Bromine	36 Kr 83.798 Krypton														
37 Rb 85.468 Rubidium	38 Sr 87.62 Strontium	39 Y 88.906 Yttrium	40 Zr 91.224 Zirconium	41 Nb 92.906 Niobium	42 Mo 95.96 Molybdenum	43 Tc (98) Technetium	44 Ru 101.07 Ruthenium	45 Rh 102.906 Rhodium	46 Pd 106.42 Palladium	47 Ag 107.868 Silver	48 Cd 112.412 Cadmium	49 In 114.818 Indium	50 Sn 118.711 Tin	51 Sb 121.760 Antimony	52 Te 127.60 Tellurium	53 I 126.904 Iodine	54 Xe 131.294 Xenon														
55 Cs 132.905 Cesium	56 Ba 137.328 Barium	57 La 138.905 Lanthanum	58 Ce 140.116 Cerium	59 Pr 140.908 Praseodymium	60 Nd 144.242 Neodymium	61 Pm (145) Promethium	62 Sm 150.36 Samarium	63 Eu 151.964 Europium	64 Gd 157.25 Gadolinium	65 Tb 158.925 Terbium	66 Dy 162.500 Dysprosium	67 Ho 164.930 Holmium	68 Er 167.259 Erbium	69 Tm 168.934 Thulium	70 Yb 173.055 Ytterbium	71 Lu 174.967 Lutetium	72 Hf 178.49 Hafnium														
87 Fr (223) Francium	88 Ra (226) Radium	89 Ac (227) Actinium	90 Th 232.038 Thorium	91 Pa 231.036 Protactinium	92 U 238.029 Uranium	93 Np (237) Neptunium	94 Pu (244) Plutonium	95 Am (243) Americium	96 Cm (247) Curium	97 Bk (247) Berkelium	98 Cf (251) Californium	99 Es (252) Einsteinium	100 Fm (257) Fermium	101 Md (258) Mendelevium	102 No (259) Nobelium	103 Lr (262) Lawrencium	104 Rf (267) Rutherfordium	105 Db (268) Dubnium	106 Sg (271) Seaborgium	107 Bh (272) Bohrium	108 Hs (270) Hassium	109 Mt (276) Meitnerium	110 Ds (281) Darmstadtium	111 Rg (280) Roentgenium	112 Cn (285) Copernicium	113 Nh (286) Nihonium	114 Fl (289) Flerovium	115 Mc (288) Moscovium	116 Lv (293) Livermorium	117 Ts (294) Tennessine	118 Og (294) Oganesson

Atomic number — 14
Symbol — **Si**
Atomic mass — 28.086
Name — Silicon

Mass numbers in parentheses are those of the most stable or most common isotope.

Lanthanide Series

Actinide Series