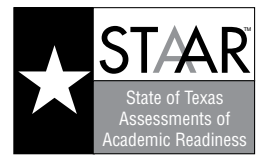


# STAAR PHYSICS REFERENCE MATERIALS



## FORCE AND MOTION

$$\text{Average velocity} = \frac{\text{displacement}}{\text{change in time}} \qquad v_{\text{avg}} = \frac{\Delta d}{\Delta t}$$

$$\text{Acceleration} = \frac{\text{final velocity} - \text{initial velocity}}{\text{change in time}} \qquad a = \frac{v_f - v_i}{\Delta t}$$

$$\text{Acceleration} = \frac{(\text{final velocity})^2 - (\text{initial velocity})^2}{2(\text{displacement})} \qquad a = \frac{v_f^2 - v_i^2}{2\Delta d}$$

$$\text{Displacement} = \left( \text{initial velocity} \right) \left( \text{change in time} \right) + \frac{1}{2} (\text{acceleration}) \left( \text{change in time} \right)^2 \qquad \Delta d = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

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

$$\text{Net force} = (\text{mass})(\text{acceleration}) \qquad F_{\text{net}} = ma$$

$$\text{Work} = (\text{force})(\text{distance}) \qquad W = Fd$$

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

$$\text{Power} = \frac{\text{work}}{\text{time}} \qquad P = \frac{W}{t}$$

$$\text{Pythagorean theorem} \qquad a^2 + b^2 = c^2$$

## GRAVITATIONAL, ELECTRICAL, AND MAGNETIC FORCES

$$\text{Force of gravitational attraction between 2 objects} = \left( \text{universal gravitation constant} \right) \left( \frac{\left( \text{mass of 1st object} \right) \left( \text{mass of 2nd object} \right)}{\left( \text{distance between centers of objects} \right)^2} \right) \qquad F_g = G \left( \frac{m_1 m_2}{d^2} \right)$$

$$\text{Force between 2 charged particles} = \left( \text{Coulomb's constant} \right) \left( \frac{\left( \text{charge of 1st particle} \right) \left( \text{charge of 2nd particle} \right)}{\left( \text{distance between particles} \right)^2} \right) \qquad F_{\text{electric}} = k_c \left( \frac{q_1 q_2}{d^2} \right)$$

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

$$\text{Current} = \frac{\text{voltage}}{\text{resistance}} \qquad I = \frac{V}{R}$$

$$\text{Equivalent resistance for resistors in series} \qquad R = R_1 + R_2 + R_3 + \dots$$

$$\text{Equivalent resistance for resistors in parallel} \qquad \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

# 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

## PERIODIC TABLE OF THE ELEMENTS

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	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36										
H	He	Li	Be	B	C	N	O	F	Ne	Na	Mg	Al	Si	P	S	Cl	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr										
1.008 Hydrogen	4.003 Helium	6.941 Lithium	9.012 Beryllium	10.812 Boron	12.011 Carbon	14.007 Nitrogen	15.999 Oxygen	18.998 Fluorine	20.180 Neon	22.990 Sodium	24.305 Magnesium	26.982 Aluminum	28.086 Silicon	30.974 Phosphorus	32.066 Sulfur	35.453 Chlorine	39.948 Argon	39.098 Potassium	40.078 Calcium	44.956 Scandium	47.867 Titanium	50.942 Vanadium	51.996 Chromium	54.938 Manganese	55.845 Iron	58.933 Cobalt	58.693 Nickel	63.546 Copper	65.38 Zinc	69.723 Gallium	72.64 Germanium	74.922 Arsenic	78.96 Selenium	79.904 Bromine	83.798 Krypton										
87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122										
Fr (223)	Ra (226)	Ac (227)	Th 232.038	Pa 231.036	U 238.029	Np (237)	Pu (244)	Am (243)	Cm (247)	Bk (247)	Cf (251)	Es (252)	Fm (257)	Md (258)	No (259)	Lr (262)	Rf (267)	Sg (271)	Bh (272)	Hs (270)	Mt (276)	Ds (281)	Rg (280)	Cd 112.412	Hg 200.59	Tl 204.383	Pb 207.2	Bi 208.980	Po (209)	At (210)	Rn (222)	Xe 131.294	I 126.904	Te 127.60	Sb 121.760	Sn 118.711	In 114.818	Cd 112.412	Hg 200.59	Tl 204.383	Pb 207.2	Bi 208.980	Po (209)	At (210)	Rn (222)
55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90										
Cs 132.905	Ba 137.328	La 138.905	Ce 140.116	Pr 140.908	Nd 144.242	Pm (145)	Sm 150.36	Eu 151.964	Gd 157.25	Tb 158.925	Dy 162.500	Ho 164.930	Er 167.259	Tm 168.934	Yb 173.055	Lu 174.967	Hf 178.49	Ta 180.948	Re 186.207	Os 190.23	Ir 192.217	Pt 195.085	Au 196.967	Hg 200.59	Tl 204.383	Pb 207.2	Bi 208.980	Po (209)	At (210)	Rn (222)	Xe 131.294	I 126.904	Te 127.60	Sb 121.760	Sn 118.711	In 114.818	Cd 112.412	Hg 200.59	Tl 204.383	Pb 207.2	Bi 208.980	Po (209)	At (210)	Rn (222)	
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136										
Uuq (101)	Uub (102)	Uuq (103)	Uuq (104)	Uuq (105)	Uuq (106)	Uuq (107)	Uuq (108)	Uuq (109)	Uuq (110)	Uuq (111)	Uuq (112)	Uuq (113)	Uuq (114)	Uuq (115)	Uuq (116)	Uuq (117)	Uuq (118)	Uuq (119)	Uuq (120)	Uuq (121)	Uuq (122)	Uuq (123)	Uuq (124)	Uuq (125)	Uuq (126)	Uuq (127)	Uuq (128)	Uuq (129)	Uuq (130)	Uuq (131)	Uuq (132)	Uuq (133)	Uuq (134)	Uuq (135)	Uuq (136)										

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

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

Lanthanide Series

Actinide Series