Example Items

Physics

Physics Example Items are a **representative set** of items for the ACP. Teachers may use this set of items along with the test blueprint as guides to prepare students for the ACP. On the last page, the correct answer, content SE and SE justification are listed for each item.

The specific part of an SE that an Example Item measures is NOT necessarily the only part of the SE that is assessed on the ACP. None of these Example Items will appear on the ACP.

Teachers may provide feedback regarding Example Items.

(1) Download the Example Feedback Form and email it. The form is located on the homepage of the Assessment website (assessment.dallasisd.org).

OR

(2) To submit directly: Login to the Assessment website. Under "News" in the left-hand column, click on "Sem 2 Example Items Download." Above the subjects, click on "Example Feedback Form."

Second Semester
2017–2018
Code #: 3111

STAAR PHYSICS
REFERENCE MATERIALS

STAAR™
State of Texas
Assessments of
Academic Readiness

FORCE AND MOTION

Average velocity $= \dfrac{\text{displacement}}{\text{change in time}}$	$v_{\text{avg}} = \dfrac{\Delta d}{\Delta t}$
Acceleration $= \dfrac{\text{final velocity} - \text{initial velocity}}{\text{change in time}}$	$a = \dfrac{v_{\text{f}} - v_{\text{i}}}{\Delta t}$
Acceleration $= \dfrac{(\text{final velocity})^2 - (\text{initial velocity})^2}{2(\text{displacement})}$	$a = \dfrac{v_{\text{f}}^2 - v_{\text{i}}^2}{2\Delta d}$
Displacement $= \left(\begin{matrix}\text{initial}\\\text{velocity}\end{matrix}\right)\left(\begin{matrix}\text{change}\\\text{in time}\end{matrix}\right) + \dfrac{1}{2}(\text{acceleration})\left(\begin{matrix}\text{change}\\\text{in time}\end{matrix}\right)^2$	$\Delta d = v_{\text{i}}\Delta t + \dfrac{1}{2}a\Delta t^2$
Centripetal acceleration $= \dfrac{(\text{tangential velocity})^2}{\text{radius}}$	$a_{\text{c}} = \dfrac{v_{\text{t}}^2}{r}$
Net force = (mass)(acceleration)	$F_{\text{net}} = ma$
Work = (force)(distance)	$W = Fd$
Torque = (force)(lever arm)	$\tau = Fr$
Power $= \dfrac{\text{work}}{\text{time}}$	$P = \dfrac{W}{t}$
Pythagorean theorem	$a^2 + b^2 = c^2$

GRAVITATIONAL, ELECTRICAL, AND MAGNETIC FORCES

Force of gravitational attraction between 2 objects $= \left(\begin{matrix}\text{universal}\\\text{gravitation}\\\text{constant}\end{matrix}\right)\left(\dfrac{\left(\begin{matrix}\text{mass of}\\\text{1st object}\end{matrix}\right)\left(\begin{matrix}\text{mass of}\\\text{2nd object}\end{matrix}\right)}{\left(\begin{matrix}\text{distance between}\\\text{centers of objects}\end{matrix}\right)^2}\right)$	$F_{\text{g}} = G\left(\dfrac{m_1 m_2}{d^2}\right)$
Force between 2 charged particles $= \left(\begin{matrix}\text{Coulomb's}\\\text{constant}\end{matrix}\right)\left(\dfrac{\left(\begin{matrix}\text{charge of}\\\text{1st particle}\end{matrix}\right)\left(\begin{matrix}\text{charge of}\\\text{2nd particle}\end{matrix}\right)}{(\text{distance between particles})^2}\right)$	$F_{\text{electric}} = k_{\text{C}}\left(\dfrac{q_1 q_2}{d^2}\right)$
Electrical power = (voltage)(current)	$P = VI$
Current $= \dfrac{\text{voltage}}{\text{resistance}}$	$I = \dfrac{V}{R}$
Equivalent resistance for resistors in series	$R = R_1 + R_2 + R_3 + \ . \ . \ .$
Equivalent resistance for resistors in parallel	$\dfrac{1}{R} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3} + \ . \ . \ .$

STAAR PHYSICS REFERENCE MATERIALS

ENERGY AND MOMENTUM

Kinetic energy $= \frac{1}{2}(\text{mass})(\text{velocity})^2$	$KE = \frac{1}{2}mv^2$
Gravitational potential energy $= (\text{mass})\left(\begin{array}{c}\text{acceleration}\\\text{due to gravity}\end{array}\right)(\text{height})$	$PE_g = mgh$
Elastic potential energy $= \frac{1}{2}\left(\begin{array}{c}\text{spring}\\\text{constant}\end{array}\right)\left(\begin{array}{c}\text{distance stretched}\\\text{or compressed}\end{array}\right)^2$	$PE_{\text{elastic}} = \frac{1}{2}kx^2$
Energy = (power)(time)	$E = Pt$
Work = change in kinetic energy	$W = \Delta KE$
Mechanical energy = kinetic energy + potential energy	$ME = KE + PE$
Law of conservation of energy	$KE_i + PE_i = KE_f + PE_f$
Momentum = (mass)(velocity)	$p = mv$
Impulse = (force)(change in time) = (mass)(change in velocity)	$J = F\Delta t = m\Delta v$
Law of conservation of momentum	$m_1v_{1_i} + m_2v_{2_i} = m_1v_{1_f} + m_2v_{2_f}$
Heat gained or lost $= (\text{mass})\left(\begin{array}{c}\text{specific}\\\text{heat}\end{array}\right)\left(\begin{array}{c}\text{change in}\\\text{temperature}\end{array}\right)$	$Q = mc_p\Delta T$

WAVES AND LIGHT

Velocity = (frequency)(wavelength)	$v = f\lambda$
$\frac{1}{\text{Focal length}} = \frac{1}{\text{distance to image}} + \frac{1}{\text{distance to object}}$	$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$
Energy $= (\text{mass})(\text{speed of light})^2$	$E = mc^2$

STAAR PHYSICS REFERENCE MATERIALS

CONSTANTS AND CONVERSIONS

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

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

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

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

m_E = mass of Earth = 5.97×10^{24} kg

r_E = radius of Earth = 6.37×10^{6} m

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

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

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

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

STAAR PHYSICS
REFERENCE MATERIALS

PERIODIC TABLE OF THE ELEMENTS

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

	1 1A	2 2A	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 8B	10	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1	1 **H** 1.008 Hydrogen																	2 **He** 4.003 Helium
2	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
3	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
4	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
5	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
6	55 **Cs** 132.905 Cesium	56 **Ba** 137.328 Barium	71 **Lu** 174.967 Lutetium	72 **Hf** 178.49 Hafnium	73 **Ta** 180.948 Tantalum	74 **W** 183.84 Tungsten	75 **Re** 186.207 Rhenium	76 **Os** 190.23 Osmium	77 **Ir** 192.217 Iridium	78 **Pt** 195.085 Platinum	79 **Au** 196.967 Gold	80 **Hg** 200.59 Mercury	81 **Tl** 204.383 Thallium	82 **Pb** 207.2 Lead	83 **Bi** 208.980 Bismuth	84 **Po** (209) Polonium	85 **At** (210) Astatine	86 **Rn** (222) Radon
7	87 **Fr** (223) Francium	88 **Ra** (226) Radium	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							

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

Lanthanide Series	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
Actinide Series	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

Updated Spring 2011

1 A scientist examined the characteristics of sound waves during one of his experiments. He examined the five different situations shown.

#1 – Sound transmitted through water.
#2 – Sound transmitted through hot air.
#3 – Sound transmitted through train tracks.
#4 – Sound transmitted through outer space.
#5 – Sound transmitted through cold air.

Which list of situations is arranged in decreasing order (fastest to slowest) for the speed of sound?

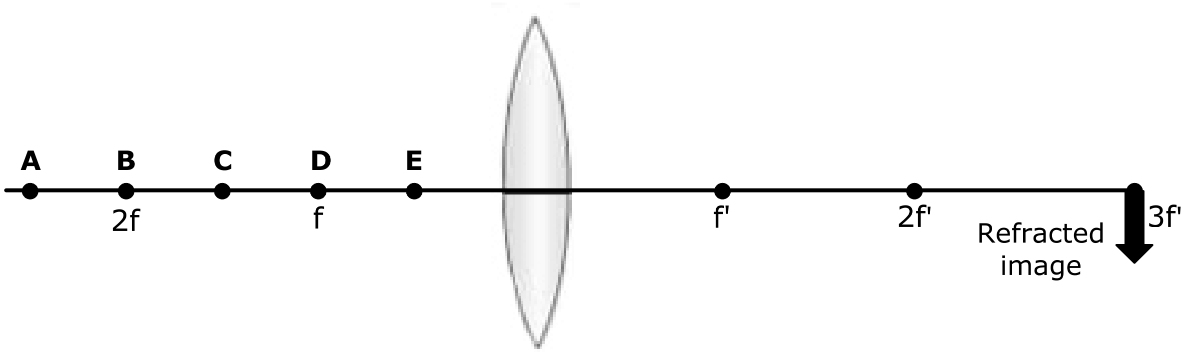
A 4, 5, 2, 1, 3

B 3, 1, 5, 2, 4

C 4, 2, 5, 1, 3

D 3, 1, 2, 5, 4

2 The location of an image is shown.



Considering refraction through a thin convex lens, where is the original object located in order to achieve this image?

A Location **A**

B Location **B**

C Location **C**

D Location **D**

3 Convection occurs in —

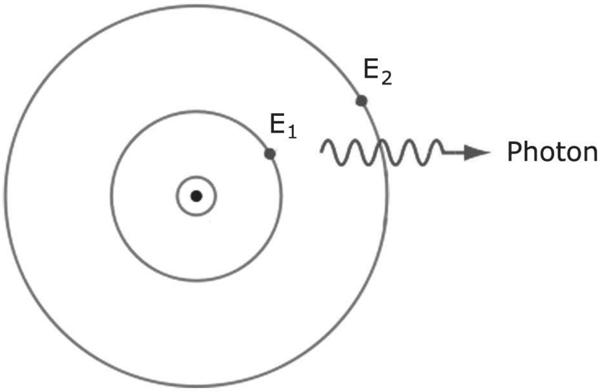
A gases only

B liquids only

C solids only

D gases and liquids only

4 How atoms emit their characteristic light is explained by Bohr's model of the atom as shown.



According to the Bohr model, which process explains how atoms give off radiation that forms their characteristic spectra?

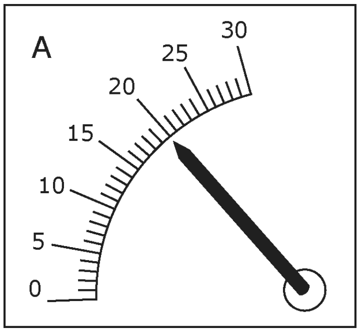
A Radiation is given off when electrons jump from a lower orbit to a higher orbit and photon energy equals $E_2 - E_1$.

B Radiation is given off when electrons jump from a lower orbit to a higher orbit and photon energy is less than $E_2 - E_1$.

C Radiation is given off when electrons jump from a higher orbit to a lower orbit and photon energy is greater than $E_2 - E_1$.

D Radiation is given off when electrons jump from a higher orbit to a lower orbit and photon energy equals $E_2 - E_1$.

5 An ammeter shows the current produced by a battery in a simple series circuit.



If the voltage across the circuit is 10 V, what is the circuit's resistance?

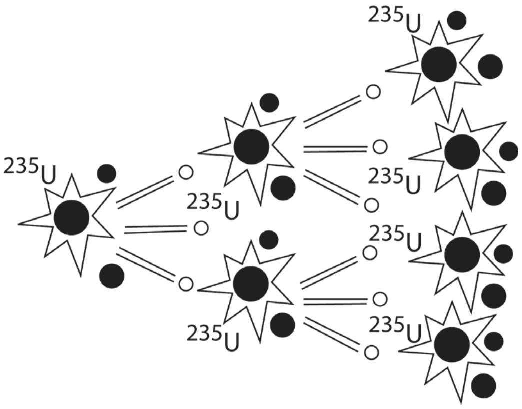
A 0.5 Ω

B 2.0 Ω

C 10.0 Ω

D 20.0 Ω

6 Nuclear fission of Uranium-235 involves a chain reaction as shown.



The chain reaction results from the fission process —

A producing electrons that can then strike and split neighboring nuclei creating a reaction that releases energy due to a change in mass of the original atom

B producing neutrons that can then strike and split neighboring nuclei creating a reaction that releases energy due to a change in mass of the original atom

C producing protons that can then strike and split neighboring nuclei creating a reaction that absorbs energy due to a change in mass of the original atom

D combining smaller-mass nuclei to form larger-mass nuclei creating a reaction that absorbs energy due to a change in mass of the original atom

7 Which statement about wave propagation is correct?

A Light waves move fastest through a diamond.

B Radio waves move faster through glass than through air.

C Sound waves move faster through air than through glass.

D Electromagnetic waves move fastest through a vacuum.

8 Doppler radar is used to determine the speed that a storm is approaching an observer. What measurable characteristic of waves is changed due to the Doppler effect to make this possible?

A Amplitude

B Interference

C Frequency

D Velocity

9 During hot summer days, automobile tires, filled with air, sometimes burst. Tires bursting due to elevated temperatures is most likely caused by —

A the tire walls becoming weaker during the summer

B an increase in the average kinetic energy of the air molecules inside the tire

C a decrease in the average kinetic energy of the air molecules inside the tire

D a higher atmospheric pressure

10 In the diagram shown, a charged object is touched to a metal sphere (Fig. A). The sphere acquires a negative charge (Fig. B), and the charge within the sphere quickly distributes itself uniformly throughout the sphere (Fig. C).

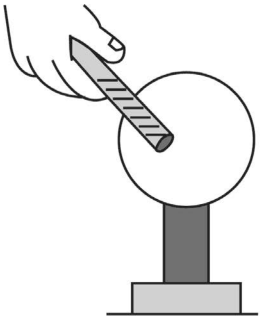


Fig. A

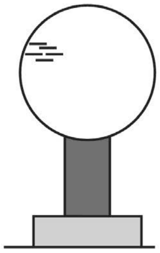


Fig. B

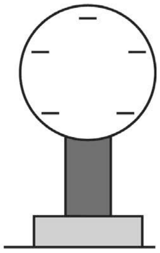


Fig. C

The sphere represents an example of a(n) —

A insulator

B electromagnet

C solenoid

D conductor

11 White light is refracted as it passes from the air into a glass prism, separating the colors that make up the original white light. This happens because —

A all light travels at the same slower velocity in glass than in air

B all light travels at the same faster velocity in glass than in air

C different colors of light travel at different speeds in glass

D red light travels faster in glass than in air

12 Photoelectrons are emitted from a metal surface when light shines on it. If the wavelength of the light is decreased, the —

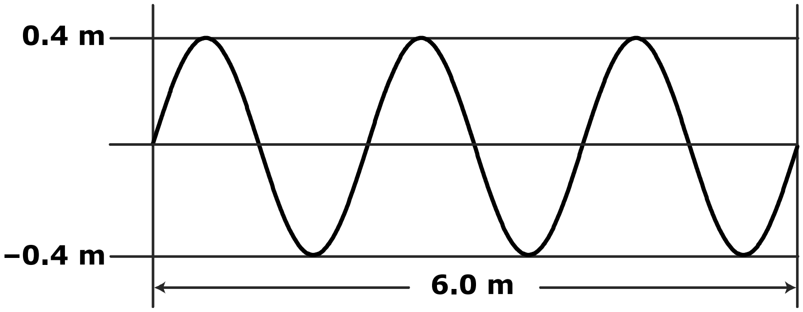
A number of electrons emitted will decrease

B kinetic energy of the emitted electrons will decrease

C number of electrons emitted will increase

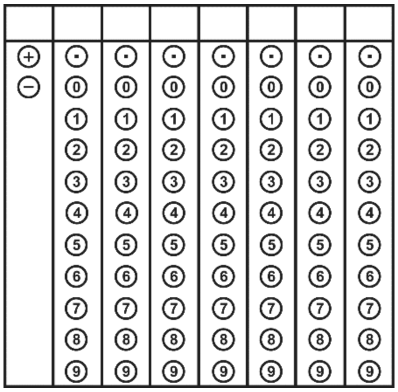
D kinetic energy of the emitted electrons will increase

13 A graph of a wave is shown.



If the frequency, f, is 8.0 Hz, what is the wave's speed in m/s?

Record the answer and fill in the bubbles on the grid provided. Be sure to use the correct place value.



14 What is the first law of thermodynamics?

A Entropy of an isolated system increases or remains the same.

B Total energy of an isolated system is conserved.

C Temperature of an object is a measure of the average kinetic energy of its molecules.

D Total momentum of an isolated system is conserved.

15 A wire loop is located in a magnetic field. When an electric current is made to flow through the loop, the loop rotates 90 degrees and then stops. This effect is the basis of what device?

A Generator

B Motor

C Transformer

D Resistor

EXAMPLE ITEMS Physics Key, Sem 2

Item#	Key	SE	Process Skills	SE Justification
1	D	P.7C	3A	Compare characteristics and behaviors of longitudinal waves, including sound waves.
2	C	P.7E	2K	Describe and predict image formation as a consequence of refraction through a thin convex lens.
3	D	P.6F	--	Give examples of different processes of thermal energy transfer, including convection.
4	D	P.8B	2K	Explain the emission spectra produced by various atoms.
5	A	P.5F	2H, 2L	Calculate in terms of current through, potential difference across, and resistance of, electric circuit elements connected in series.
6	B	P.8C	2K	Describe the significance of mass-energy equivalence and apply it in explanations of phenomena such as fission.
7	D	P.7A	--	Describe wave propagation in various types of media.
8	C	P.7F	2K	Describe the role of wave behaviors in industrial applications.
9	B	P.6E	2K, 3A	Describe how the macroscopic properties of a thermodynamic system such as temperature are related to the molecular level of matter, including kinetic energy of atoms.
10	D	P.5E	--	Characterize materials as conductors based on their electrical properties.
11	C	P.7D	--	Investigate behaviors of waves including refraction.
12	D	P.8A	--	Describe the photoelectric effect.
13	16	P.7B	--	Calculate using the relationship between wave speed, frequency, and wavelength.
14	B	P.6G	--	Analyze the laws of thermodynamics, including the law of conservation of energy.
15	B	P.5G	--	Describe the relationship between electric and magnetic fields in applications such as motors.