Example Items

Physics
Pre-AP

Physics Pre-AP 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: https://assessment.dallasisd.org.

OR

(2) To submit directly, click "Example Feedback – online form" **after** you click the Example Items link under ACP Resources on the ACP tab on the Assessment website.

First Semester
2020–2021
Code #: 3211

STAAR PHYSICS REFERENCE MATERIALS

FORCE AND MOTION

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

GRAVITATIONAL, ELECTRICAL, AND MAGNETIC FORCES

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

STAAR PHYSICS REFERENCE MATERIALS

ENERGY AND MOMENTUM

Kinetic energy $= \frac{1}{2}$(mass)(velocity)^2	$KE = \frac{1}{2}mv^2$
Gravitational potential energy $=$ (mass)$\left(\begin{matrix}\text{acceleration}\\ \text{due to gravity}\end{matrix}\right)$(height)	$PE_g = mgh$
Elastic potential energy $= \frac{1}{2}\left(\begin{matrix}\text{spring}\\ \text{constant}\end{matrix}\right)\left(\begin{matrix}\text{distance stretched}\\ \text{or compressed}\end{matrix}\right)^2$	$PE_{\text{elastic}} = \frac{1}{2}kx^2$
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 $=$ (mass)$\left(\begin{matrix}\text{specific}\\ \text{heat}\end{matrix}\right)\left(\begin{matrix}\text{change in}\\ \text{temperature}\end{matrix}\right)$	$Q = mc_p\Delta T$

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

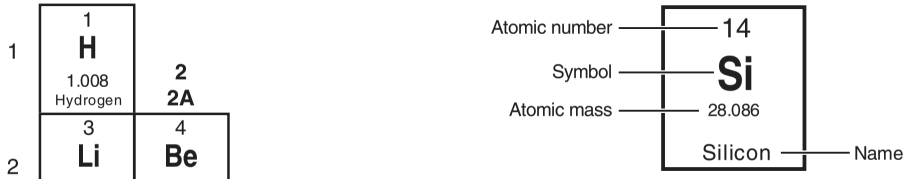
joule (J) = $\text{N} \cdot \text{m}$

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

STAAR™ State of Texas Assessments of Academic Readiness



	1 1A												13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1	1 H 1.008 Hydrogen	2 2A																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	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 8B	10	11 1B	12 2B	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

EXAMPLE ITEMS Physics Pre-AP, Sem 1

1 John sees Hua running towards him at 11 m/s. While running, Hua throws a ball to John at 5 m/s. What is the speed of the ball as observed by John?

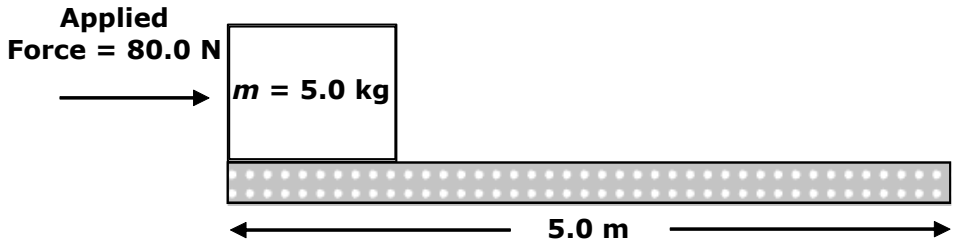
A 5 m/s

B 6 m/s

C 16 m/s

D 55 m/s

2 A block with a mass of 5.0 kg is pushed on a frictionless surface through a distance of 5.0 m by applying a horizontal force of 80.0 N.



If the block starts from rest, what is its final velocity?

A 8.9 m/s

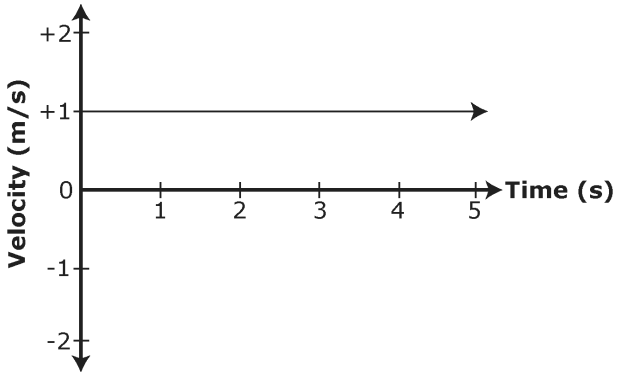
B 12.6 m/s

C 16.0 m/s

D 31.6 m/s

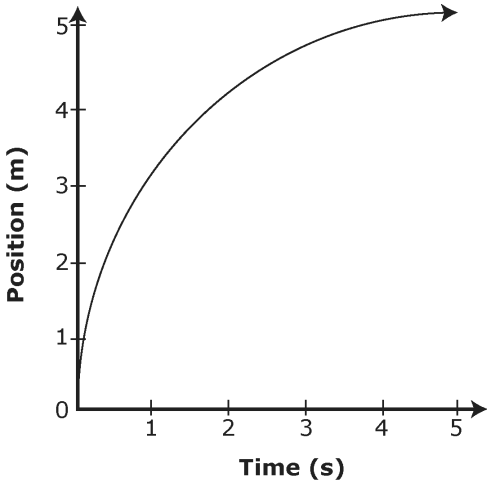
EXAMPLE ITEMS Physics Pre-AP, Sem 1

3 An object moves in a straight line at a constant velocity of 1 m/s as shown in the velocity-time graph.

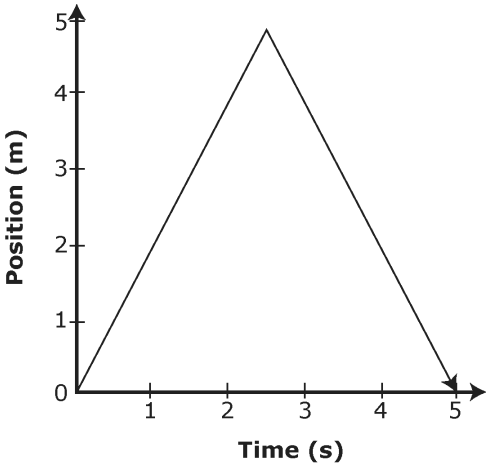


What position-time graph is represented by the motion indicated in the velocity-time graph?

A



C



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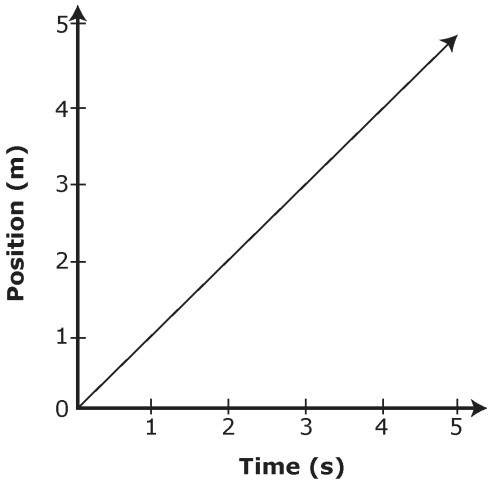

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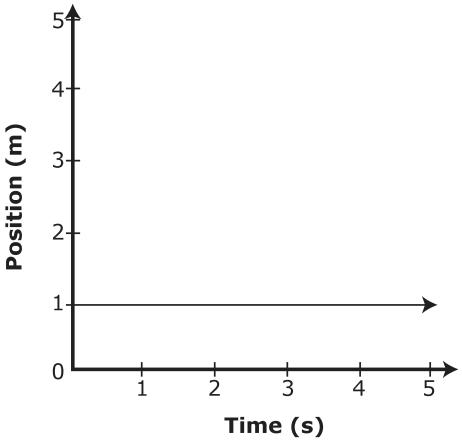
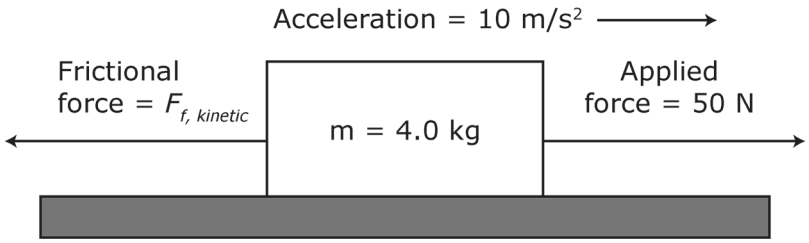


EXAMPLE ITEMS Physics Pre-AP, Sem 1

4 The diagram shows a 4.0 kg object accelerating at 10 m/s^2 on a rough, horizontal surface.



What is the magnitude of the kinetic frictional force ($F_{f, kinetic}$) acting on the object?

A 50 N

B 40 N

C 20 N

D 10 N

5 If the mass of a balloon is 300 kg and the lift force provided by the atmosphere is 3300 N, what is the net force on the balloon?

A Upward, 360 N

B Downward, 300 N

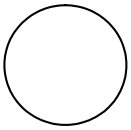
C Toward the north, 300 N

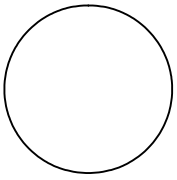
D Toward the east, 360 N

6 If the circles shown represent the relative sizes of four planets that all have the same mass, which planet exerts the greatest gravitational pull on objects on its surface?

A 

B 

C 

D 

EXAMPLE ITEMS Physics Pre-AP, Sem 1

7 A rock is thrown downward with a velocity of 25 m/s from the edge of a cliff which is 50 meters high. What is the approximate speed of the rock just before it hits the ground at the base of the cliff?

A 33 m/s

B 40 m/s

C 56 m/s

D 75 m/s

8 The table shows the mass, velocity and height of four different objects.

Object	Mass (kg)	Velocity (m/s)	Height (m)
A	0.5	4.0	5
B	1.0	4.0	3
C	2.0	2.0	2
D	4.0	1.0	1

Which object has the most mechanical energy?

A Object A

B Object B

C Object C

D Object D

9 Which statement accurately describes what happens as a ball falls freely (without air resistance) toward the ground?

A The total mechanical energy of the ball increases, but its kinetic energy decreases.

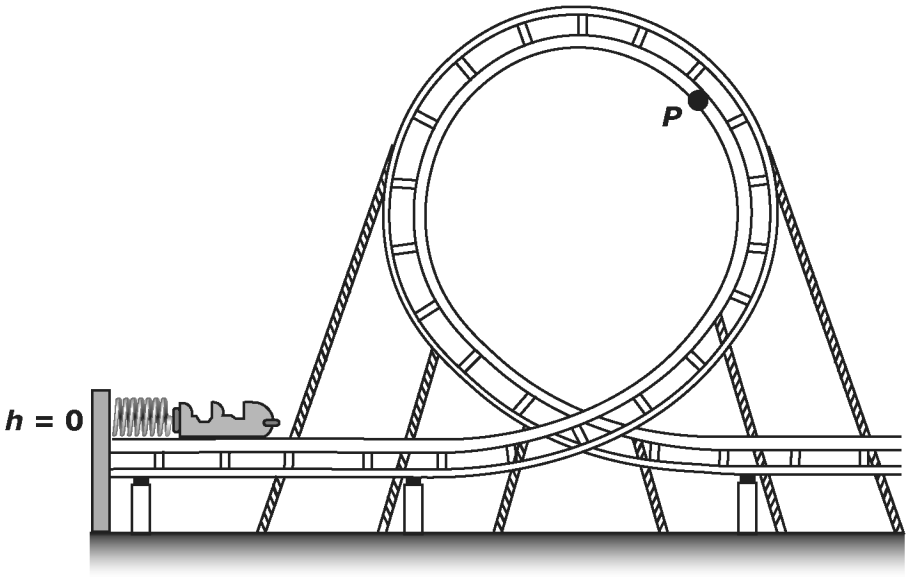
B The total mechanical energy of the ball decreases, but its potential energy increases.

C The total mechanical energy of the ball remains the same, but its kinetic energy decreases.

D The total mechanical energy of the ball remains the same, but its potential energy decreases.

EXAMPLE ITEMS Physics Pre-AP, Sem 1

10 A rollercoaster cart is launched into a loop by a compressed spring that stores 10,000 Joules of energy.



Source: stickpng.com

If the starting position is considered zero height (h=0) and there is no friction or air resistance, which pair of numbers describes possible values for the kinetic energy, *KE*, and the gravitational potential energy, *PE*, at point *P*?

A *KE* = 0 Joules
PE = 11,000 Joules

B *KE*= 9,000 Joules
PE= 3,000 Joules

C *KE* = 3,000 Joules
PE = 7,000 Joules

D *KE* = 7,000 Joules
PE = 1,000 Joules

11 A toy car is rounding a circular track with a radius of 1.50 m. The car goes around the track once in 20.0 seconds. What is the centripetal acceleration of the car in m/s^2?

(Circumference = $2\pi r$)

A 0.12 m/s^2

B 0.15 m/s^2

C 0.31 m/s^2

D 1.20 m/s^2

EXAMPLE ITEMS Physics Pre-AP Key, Sem 1

Item#	Key	SE	Process Skills	SE Justification
1	C	P.4B	2G, 2J	Describe motion relative to different frames of reference.
2	B	P.6A	2G, 2H, 2J	Calculate quantities using the work-energy theorem in various situations.
3	B	P.4A	2G, 2H, 2J	Interpret graphs describing different types of motion.
4	D	P.4D	2G, 2H, 2J	Calculate the effect of forces on objects, including the relationship between force and acceleration.
5	A	P.4D	2G, 2J	Calculate the effect of forces on objects.
6	A	P.5B	2H	Describe how the magnitude of the gravitational force between two objects depends on the distance between their centers.
7	B	P.4B	2G, 2J	Analyze motion in one dimension using equations with the concepts of displacement, instantaneous velocity, and acceleration.
8	C	P.6C	2H, 2J	Calculate the mechanical energy of a physical system.
9	D	P.6B	--	Investigate examples of kinetic and potential energy and their transformations.
10	C	P.6D	2G, 2J	Apply the law of conservation of energy.
11	B	P.4C	2G, 2H, 2J	Analyze accelerated motion in two dimensions using equations, including circular examples.