Name:				Tuesday, October 31, 2017
Ku: /45	App: /10	T&I: /	Com:	

This is a copy of a unit test from 2008. This will be similar to the unit test you will be writing next Monday. As you can see there are quite a few questions on the test. When you write a unit test you should always make sure you answer the following questions first. Start with the questions that are worth the most in the knowledge section. Then focus on "Application" / "Thinking & Investigation" questions. Since we only have one application question per test usually, each question is worth a significant amount because it marked in a separate category. The same applies to the "T&I" questions. Then complete the "short answer multiple choice" followed by the regular multiple choice last. Why do the multiple choice questions last? Because you can always guess if you run out of time.

Multiple Choice [ku: 9]

Identify the letter of the choice that best completes the statement or answers the question.

____1. Which of the following is a "scalar" quantity?

a. distance
b. velocity
c. acceleration
d. displacement
e. none of the above

____2. The term "uniform motion" means

a. acceleration is constant
b. speed is constant
c. velocity is constant
d. displacement is constant
e. velocity is zero

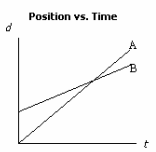
____3. The slope of a position-time graph always represents

a. displacement
b. distance
c. velocity
d. change in velocity
e. acceleration

____4. The area under a velocity-time graph always represents

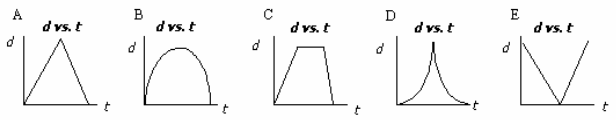
a. displacement
b. change in velocity
c. distance
d. acceleration
e. change in acceleration

____5. The position-time graph pictured below represents the motions of two objects, A and B. Which of the following statements concerning the objects' motions is true?



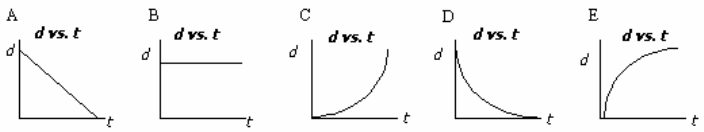
a. Object B travels the greater distance.
b. Object A has the greater speed.
c. Object A leaves the reference point at an earlier time.
d. Both objects have the same speed at the point where the lines cross.
e. Object A is travelling for a longer period of time.

____6. The position-time graph that depicts a ball thrown vertically upward that returns to the same position is



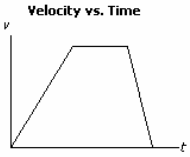
a. A
s B
c. C
d. D
e. E

____7. The position-time graph that represents "uniform motion" is



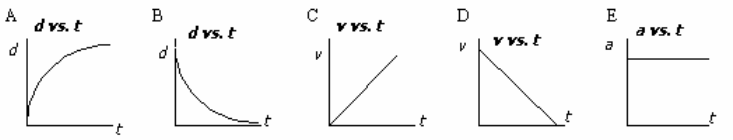
a. A
b. B
c. C
d. D
e. E

____8. Consider the following velocity-time graph and select the statement that is true.



a. At no time can the motion be considered "uniform."
b. The object returns to its original position.
c. The object travels in one direction and then the other.
d. The object is accelerating throughout the entire recorded time.
e. The object speeds up and later slows down.

____9. Four of the five graphs pictured below could all represent the same motion. Which graph does not belong to this group?



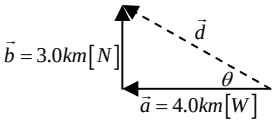
This question actually has a conceptual problem. A and D represent negative acceleration ("frownie bits) and B, C, and E represent positive acceleration "smiley bits"… therefore the question is not clear.

a. A
b. B
c. C
d. D
e. E

Short Answer Multiple Choice (**GRFS** is **NOT** required) **[ku: 18]**

____10. A cyclist rides a bicycle 4.0 km west, then 3.0 km north. What is the cyclist's displacement?

a. 7.0 km [37° N of W]
b. 7.0 km [37° W of N]
c. 5.0 km [37° N of W]
d. 5.0 km [37° W of N]
e. 1.0 km [37° W of N]



$$\left|\vec{d}\right| = \sqrt{a^2 + b^2}$$
$$= \sqrt{4^2 + 3^2}$$
$$= 5$$

$$\tan\theta = \frac{b}{a}$$
$$\theta = \tan^{-1}\left(\frac{3}{4}\right)$$
$$\theta = 37^0$$

____11. A car drives 6.0 km [E], then 8.0 km [S] in a total time of 0.30 h. What is the car's average speed?

a. 33 km/h
b. 47 km/h
c. 33 km/h [E of S]
d. 47 km/h [E of S]
e. 47 km/h [S of E]

$$v_{avg} = \frac{d_{total}}{t_{total}}$$
$$v_{avg} = \frac{a+b}{t_{total}}$$
$$v_{avg} = \frac{6.0+8.0}{0.30}$$
$$v_{avg} = 47km/h$$

____12. If an object accelerates at 6.2 m/s^2 [N], how long will it take to reach a velocity of 25 m/s [N] if starting from rest?

a. 25 s
b. 4.0 m/s
c. 31 s
d. 0.25 s
e. 4.0 s

$\vec{a} = 6.2 m/s^2 [N]$ $\vec{v}_1 = \vec{0} m/s$ $\vec{v}_2 = 25 m/s [N]$	$\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$ $\Delta t = \frac{\Delta \vec{v}}{\vec{a}}$ $\Delta t = \frac{+25 - 0}{6.2}$ $\Delta t = 4.0$

___13. An object is thrown vertically upward at 25.0 m/s. If it experiences an acceleration due to gravity of 9.8 m/s^2 [down], what is the object's velocity 3.0 s later?

a. 22 m/s [down]
b. 22 m/s [up]
c. 4 m/s [up]
d. 4 m/s [down]
e. zero (it has hit the ground)

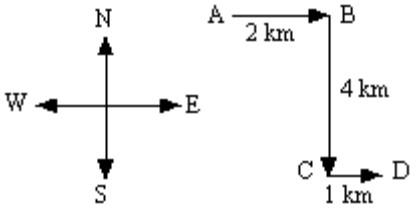
$v_1 = +25.0 m/s$ $a = -9.8 m/s^2$ $t = 3.0 s$	$v_2 = v_1 + at$ $v_2 = +25.0 + (-9.8)(3.0)$ $v_2 = -4.4 m/s$

____14. A stone is thrown vertically downward with a speed of 10 m/s from a bridge. Accelerating under gravity (9.8 m/s^2), the stone strikes the water 1.8 s later. From what height above the water was the stone thrown? (Assume 2 significant digits.)

a. 50 m
b. 34 m
c. 27 m
d. 15 m
e. 3 m

$v_1 = -10 m/s$ $a = -9.8 m/s^2$ $t = 1.8 s$	$d = v_1 t + \frac{1}{2} a t^2$ $d = (-10)(1.8) + \frac{1}{2}(-9.8)(1.8)^2$ $d = -34 m$

____15. The diagram below shows the first three legs of a trip: A to B, B to C, and C to D. If a person returns from point D to point A, what is the displacement for this fourth and final leg?



a. 7 km [37° W of N]
b. 5 km [37° W of N]
c. 5 km [37° E of S]
d. 7 km [37° E of S]
e. 5 km [37° N of E]

$\lvert\vec{d}\rvert = \sqrt{x^2 + y^2}$ $\lvert\vec{d}\rvert = \sqrt{(3)^2 + (4)^2}$ $\lvert\vec{d}\rvert = 5m$	$\tan\theta = \frac{x}{y}$ $\theta = \tan^{-1}\left(\frac{3}{4}\right)$ $\theta = 37^0$

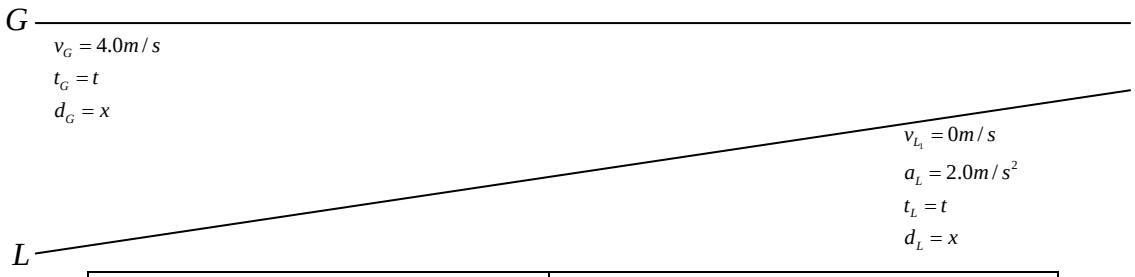
Problems Solving (All questions should be completed in the GRFS format)

1. Mr. LoRusso is standing in the hall checking a text message when Mr. Geddes runs by and shouts "NO PERSONAL ELECTRONIC DEVICES!!!" then grabs the cell phone and runs through the hall at a constant speed of 4.00 m/s, laughing maniacally all the while. Mr. LoRusso instantaneously chase after him accelerating at a rate of $2.0\,m/s^2$ shouting at him "Wait!!! I was texting my mom!!!" Determine: **[ku: 8]**

   a) how long it takes for Mr. LoRusso to catch up to Mr. Geddes. (include a diagram)

   b) how far Mr. LoRusso had to run to catch up to him.

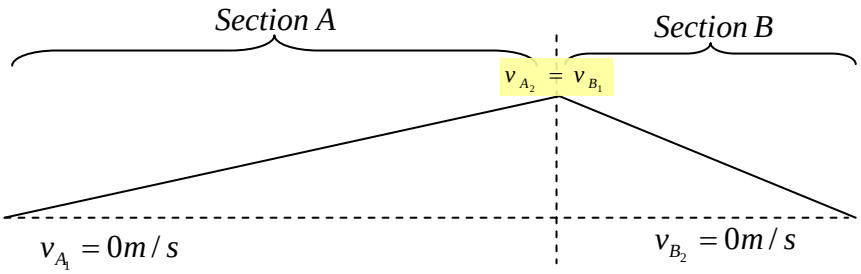
   (Express your answers in parts a) and b) to the correct number of sig. figs.)



LoRusso	Geddes
$d_L = v_{L_1}t_L + \frac{1}{2}a_L{t_L}^2$ $x = 0t + \frac{1}{2}(2.0)t^2$ $x = 1.0t^2 \quad (1)$	$d_G = v_G t_G$ $x = 4.0t \quad (2)$
Sub (1) into (2)	Sub t=4.0s into (2)
$1.0t^2 = 4.0t$ $1.0t = 4.0$ $t = 4.0s$	$x = 4.0(4.0)$ $x = 16m$

2. After Mr. LoRusso intercepts and retrieves his phone from Mr. Geddes, he stops then turns and runs the other way for 4s, accelerating at a rate of $1.5\,m/s^2$ at which point he trips and slides forward for another 3.0s before he comes to a stop right at Mr. Gorski's feet. **[ku: 10]**

a) How far did Mr. LoRusso run before he tripped? (include a diagram)
b) How fast was he going before he tripped?
c) How far did he slide?
d) What was his rate of acceleration during the slide?



$v_{A_1} = 0m/s$
$a_A = 1.5m/s^2$
$d_A = ?$
$t_A = 4.0s$

$v_{B_2} = 0m/s$
$a_B = ?$
$d_B = ?$
$t_B = 3.0s$

a) Find d_A	b) Find v_{A_2}	c) Find d_B	d) Find a_B
$d_A = v_{A_1}t_A + \frac{1}{2}a_L t_L{}^2$ $d_A = (0)(4.0) + \frac{1}{2}(1.5)(4.0)^2$ $d_A = 12m$	$v_{A_2} = v_{A_1} + a_A t_A$ $v_{A_2} = (0) + (1.5)(4.0)$ $v_{A_2} = 6.0m/s$ $v_{A_2} = v_{B_1} = 6.0m/s$	$d_B = \frac{1}{2}(v_{B_1} + v_{B_2})t_B$ $d_B = \frac{1}{2}(6.0 + 0)(3.0)$ $d_B = 9.0m$	$a_B = \frac{\Delta v_B}{\Delta t_B}$ $a = \frac{v_{B_2} - v_{B_1}}{\Delta t_B}$ $a = \frac{(0) - (6.0)}{(3.0)}$ $a = -2.0m/s^2$

Application

When a skydiver jumps from an airplane she can reach speeds near 140 km/h during the freefall portion of the dive. Once the parachute is deployed the parachutist's speed decreases to 10 km/h. Explain why then in physics we consider the acceleration during the freefall to be negative and the acceleration during the time the parachute is deployed to be positive by using your knowledge of vectors and kinematics.

Since the skydiver jumps from a plane the acceleration due to gravity causes the divers speed to increase in the negative direction. Therefore the diver's velocity continues to become more negative over time. If the diver is traveling at a speed of 140km/h, his/her velocity would be -140km/h or 140km/h [D]. Once he/she pulls deploys the parachute, the speed begins to decrease meaning that the velocity is becoming less negative. i.e. changing from -140km/h to -10km/h. Therefore from a vector perspective the change in velocity is positive (i.e. $\Delta\vec{v} = \vec{v}_2 - \vec{v}_1 = (-10) - (-140) = +130m/s$) Since the velocity change is positive, therefore the acceleration must be positive ($\vec{a} = \frac{\Delta\vec{v}}{\Delta t}$)