Physics 2101, First Exam, Spring 2008

January 22, 2008

- Please turn OFF your cell phone and MP3 player!
- Write your name and section number in the front of the scantron form.
- Bubble in your name on the back of the scantron form, LAST name first.
- DO NOT bubble in your SSN or LSU ID number.
- Make sure to mark your answers in the scantron form with a #2 black pencil.
- You can mark your answers in this exam form too, and keep it for reference. We will show the key at the end of the exam, so you can know the grade you will receive.
- Feel free to detach, use and keep the formula sheet. No other reference material is allowed during the exam.
- You may use scientific or graphing calculators.

This is a diagnostic exam on material whose knowledge is required for this class, from chapters 1-6 in the textbook, and covered in Phys 1100 (although you may have tested out of Phys 1100). We will make heavy use in the rest of the course of the concepts in these introductory chapters. We will review this material the first week of classes, but if you don't know the material already, you will not be able to learn it in a week, or do well in the class. The test is expected to reveal any weaknesses that you may have in your knowledge of the material, so make sure you act on the test results! We will announce the answers at the end of the test and link the solutions in the announcements in the course page:

`http://www.phys.lsu.edu/classes/spring2008/phys2101/`

You should know how you did immediately after finishing the test. If you do not do at least reasonably well (60% or better), you should seriously consider dropping the course. The deadline for add a course (Phys 1100, for example) and for dropping without a W is midnight Tuesday Jan 22 (tonight!), so you have a few hours after the exam.

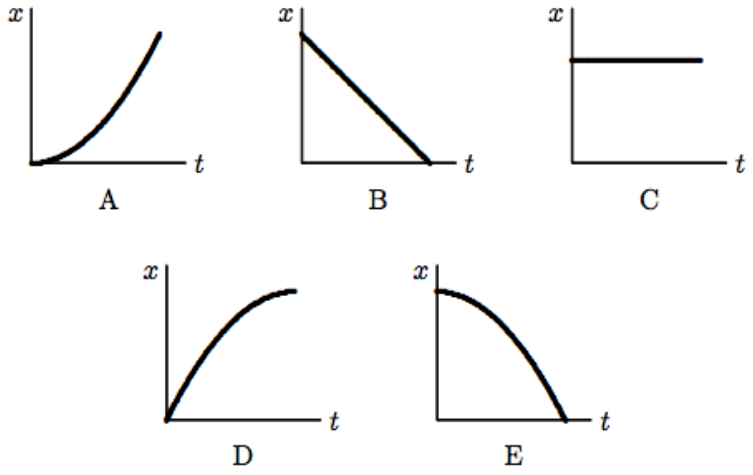
1. During a short interval of time the speed v in m/s of an automobile is given by $v = at^2 + bt^3$, where the time t is in seconds. The units of the constants a and b are respectively:

   (a) $\mathrm{m} \cdot \mathrm{s}^2$; $\mathrm{m} \cdot \mathrm{s}^4$
   (b) s^3/m; s^4/m
   (c) m/s^2; m/s^3
   (d) m/s^3; m/s^4
   (e) m/s^4; m/s^5

2. Two automobiles are 150 kilometers apart and traveling toward each other. One automobile is moving at 60 km/h and the other is moving at 40 km/h. In how many hours will they meet?

   (a) 2.5 hrs
   (b) 2.0 hrs
   (c) 1.75 hrs
   (d) 1.5 hrs
   (e) 1.25 hrs

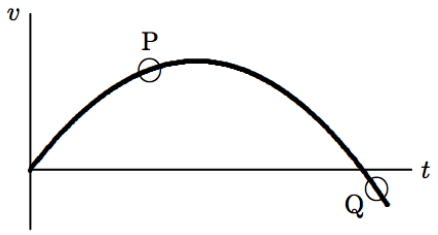
3. The plots below show the position versus time for the motion of five different particles. Which particle is speeding up towards the origin of the x-axis?



4. How far does a car travel in 6 s if its initial velocity is 2 m/s and its acceleration is $2\mathrm{m}/\mathrm{s}^2$ in the forward direction?

   (a) 12 m
   (b) 14 m
   (c) 24 m
   (d) 36 m
   (e) 48 m

5. The diagram shows a velocity-time graph for a car moving in a straight line. At point Q the car must be:



(a) moving with zero acceleration

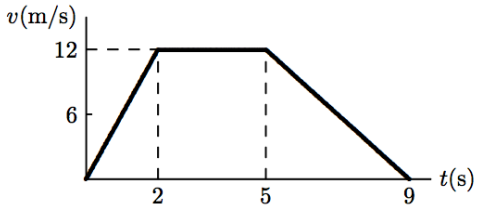
(b) traveling downhill

(c) traveling below ground-level

(d) reducing speed

(e) traveling in the reverse direction to that at point P

6. The graph represents the velocity versus time for a car moving on a straight line. How far does the car travel between t= 5 s and t= 9 s?



(a) 4 m

(b) 12 m

(c) 24 m

(d) 36 m

(e) 60 m

7. An object is shot vertically upward. While it is rising:

(a) its velocity and acceleration are both upward

(b) its velocity is upward and its acceleration is downward

(c) its velocity and acceleration are both downward

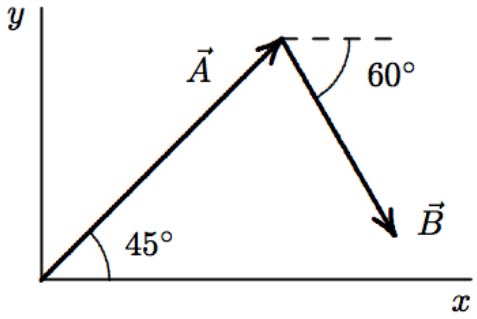
(d) its velocity is downward and its acceleration is upward

(e) its velocity and acceleration are both decreasing

8. One object is thrown vertically upward with an initial velocity of 100 m/s and another object with an initial velocity of 10 m/s. The maximum height reached by the first object will be _____ that of the other.

   (a) 10 times
   (b) 100 times
   (c) 1,000 times
   (d) 10,000 times
   (e) none of these

9. In the diagram, $\vec{A}$ has magnitude 12 m and $\vec{B}$ has magnitude 8 m. The x component of $\vec{A} + \vec{B}$ is about:

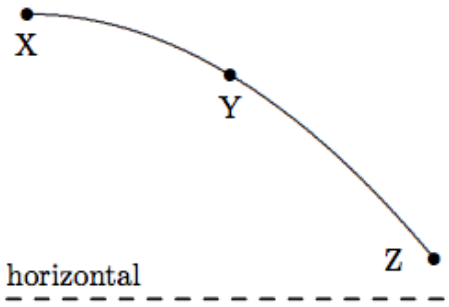


   (a) 8.9 m
   (b) 12.5 m
   (c) 15.4 m
   (d) 14.4 m
   (e) 20 m

10. The value of $\hat{k} \cdot (\hat{k} \times \hat{i})$ is:

   (a) zero
   (b) $+1$
   (c) -1
   (d) 3
   (e) $\sqrt{3}$

11. A stone is thrown horizontally and follows the path XYZ shown. Neglecting air resistance, the direction of the acceleration of the stone at point Y is:



(a) ↓
(b) →
(c) ↘
(d) ↙
(e) ↗

12. A bomber flying in level flight with constant velocity releases a bomb before it is over the target. Neglecting air resistance, which one of the following is NOT true?

(a) The bomber is over the target when the bomb strikes.
(b) The acceleration of the bomb is constant.
(c) If the plane is flying faster, the bomb would take shorter time to reach the ground.
(d) The bomb travels in a curved path.
(e) The time of flight of the bomb is independent of the horizontal speed of the plane.

13. A large cannon is fired from the ground at an angle of 30° above the horizontal, and then flies over level ground. The muzzle speed is 0.98 km/s. Neglecting air resistance, the projectile will travel what horizontal distance before striking the ground?

(a) about 4.3 m
(b) about 8.5 km
(c) about 43 km
(d) about 85 km
(e) about 170 km

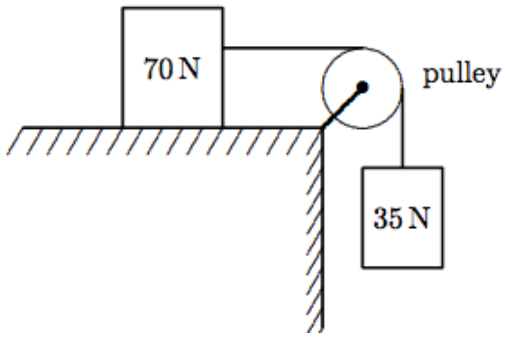
14. A stone is tied to a string and whirled at constant speed in a horizontal circle. The speed is then doubled without changing the radius of its circular path. Afterward the magnitude of the acceleration of the stone is:

    (a) the same
    (b) twice as great
    (c) four times as great
    (d) half as great
    (e) one-fourth as great

15. A car travels east at constant velocity. The net force on the car is:

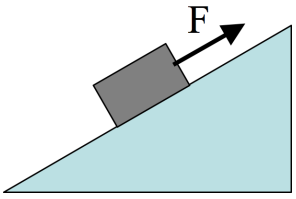
    (a) east
    (b) west
    (c) up
    (d) down
    (e) zero

16. Two blocks, weighing 70-N and 35-N respectively, are connected by a string and a pulley of negligible mass as shown in the figure. The pulley and the surface are frictionless. The magnitude of the acceleration of the 35-N block is



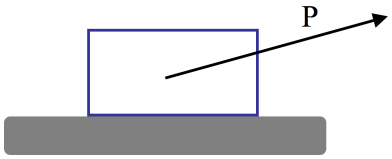
    (a) 1.6m/s^2
    (b) 3.3m/s^2
    (c) 4.9m/s^2
    (d) 6.7m/s^2
    (e) 9.8m/s^2

17. A 32-N force, parallel to the incline, is required to push a certain crate at constant velocity up a frictionless incline that is 30° above the horizontal. The mass of the crate is:



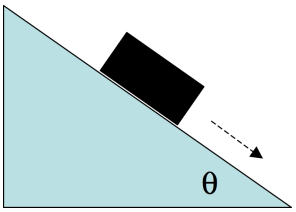
(a) 3.3 kg
(b) 3.8 kg
(c) 5.7 kg
(d) 6.5 kg
(e) 160 kg

18. A boy pulls a wooden box along a rough horizontal floor at constant velocity by means of a force $\vec{P}$ as shown. If f is the magnitude of the frictional component of the surface force (friction force), F_N is the magnitude of the normal component of the surface force (normal force), and F_g is the magnitude of the force of gravity, which of the following must be true?



(a) $P = f$ and $F_N = F_g$
(b) $P = f$ and $F_N > F_g$
(c) $P > f$ and $F_N < F_g$
(d) $P > f$ and $F_N = F_g$
(e) none of these

19. A crate is sliding down an incline that is 35° above the horizontal. If the coefficient of kinetic friction is $\mu_k = 0.40$, the acceleration of the crate is:



(a) 0

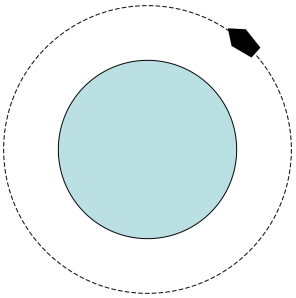
(b) 2.4m/s^2

(c) 5.8m/s^2

(d) 8.8m/s^2

(e) 10.3m/s^2

20. If a satellite moves in a circular orbit with constant speed above Earth's atmosphere (where there is no friction), then:



(a) its acceleration and velocity are always in the same direction.

(b) the net force on it is zero.

(c) its velocity is constant.

(d) its acceleration is constant.

(e) its acceleration is toward the center of the Earth.