1 At a particular instant of time,

a. the velocity vector equals the acceleration vector.

b. the velocity vector is zero if the acceleration vector is zero.

c. the acceleration vector is zero if the velocity vector is zero.

d. the velocity vector and the acceleration vector can each be anything.

2 Galileo asserted that a moving object

a. always come to rest eventually.

b. requires a force to keep moving.

c. does not require a force to keep moving.

3 A ball is thrown straight upward and reaches its highest point (5 meters above its starting point) after one second and then starts to fall back down. What is its instantaneous velocity at the instant it reaches its highest point?

a. -5 m/s.

b. +5 m/s.

c. +10 m/s.

d. 0 m/s.

e. -10 m/s.

4 An airplane's rate of climb is just the rate of increase in its distance above sea-level. Suppose that an airplane is just pulling out of a dive and its rate of climb changes from -5m/s to $+5$m/s in just one second. What is its vertical component of acceleration?

a. -10m/s^2.

b. -20m/s^2.

c. $+10\text{m/s}^2$.

d. -5m/s^2.

e. $+20\text{m/s}^2$.

5 Galileo's approach to finding the laws that govern falling objects was to

a. prove the superiority of his own theory.

b. find logical contradictions in the established theory.

c. accept the established theory.

d. test the predictions of the established theory.

6 The velocity vector of an object that is moving in a straight line always

a. has the same length.

b. stays the same in both length and direction.

c. points in the same direction.

d. changes.

7 At 3:30 P.M. a swimming pool contains 2500 gallons of water. At 4:00 P.M. it contains 2000 gallons of water. The *rate* of change in the amount of water in the pool is

a. - 500 gal/hr.

b. +1000 gal/hr.

c. -1000 gal/hr.

d. + 500 gal/hr.

e. + 2500 gal/hr.

8 A cyclist travels 50 miles in 10 hours. Her speed is

a. 50mi/ hr.

b. $1/5$hr/mi.

c. 10mi/ hr.

d. 5mi/hr.

e. $1/10$hr/mi.

9 Which of the following statements is scientific (as defined by Popper)?

a. The Minoans were the best civilization on Crete.

b. The Minoans were not the best civilization on Crete.

c. The Minoans were not the first civilization on Crete.

d. The Minoans were the first civilization on Crete.

10 A skateboarder launches herself from a ramp and flies through the air. Assume that air resistance can be neglected (not true in this case, by the way) and that she does not alter her take-off angle by flexing her legs. To remain airborne for the largest possible distance, she need the ramp to make an angle of

a. 60 from the horizontal.

b. 30 degrees from the horizontal.

c. 45 degrees from the horizontal.

d. 0 degrees from horizontal.

e. 20 degrees from the horizontal.

11 A clay pigeon is fired straight up and reaches its highest point three seconds later. What was its initial speed?

a. $300\,\mathrm{m/s}$.

b. $10\,\mathrm{m/s}$.

c. $3\,\mathrm{m/s}$.

d. $30\,\mathrm{m/s}$.

12 Mean Manfred is standing watch in the crow's nest of a tall sailing ship. He gets that duty a lot because everyone feels much safer with him as far away as possible. Also he smells bad. Old MM has already tried dropping lead sinkers on fellow crewman on the deck below. The captain told him that he would be shot if he tried that again. This time, a thoroughly bored Mean Manfred decides to engage in a game of "dolphin bonking". The dolphins swim beside the ship because they like to play in the bow wave. As the ship rocks back and forth, the crow's nest sways out over one side of the ship and then out over the other. When MM finds himself directly over a dolphin, he drops a lead sinker. The ship is under full sail and plowing along at 20 knots. By the time the lead sinker reaches the water level,

a. the falling sinker leaves the ship and dolphin behind and lands ahead of the dolphin.

b. it is still directly over the dolphin and hits the poor creature.

c. the ship and the swimming dolphin have left the falling sinker behind and it misses the dolphin.

13 Galileo's experiments were designed to reveal the simple laws of motion by

a. creating entirely new events.

b. creating simplified events.

c. adding to ordinary events.

d. reproducing ordinary events.

14 A ball is thrown straight up with an initial velocity of 5m/s. The ball is fairly heavy, so air resistance can be neglected. How fast will it be going when it falls back to the level at which it was thrown?

a. $0\,\mathrm{m/s}$.

b. $50\,\mathrm{m/s}$.

c. $5\,\mathrm{m/s}$.

d. $10\,\mathrm{m/s}$.

e. $0.2\,\mathrm{m/s}$.

15 As the Earth moves around the Sun, the Earth's acceleration vector points

a. nowhere because it's zero.

b. towards the Sun.

c. in its direction of motion.

d. away from the Sun.

16 An electromagnetic "rail-gun" capable of launching projectiles at speeds greater than five miles per second is set up at sea-level. In fact, most of the rail-gun's two-mile length is submerged below the Pacific Ocean with just the exit end above the water. The gun launches its projectiles at an angle of 45 degrees to the horizontal. Assume that the projectiles from this gun make it out of the earth's atmosphere with speeds that are still above five miles per second. No matter how fast these projectiles are going when they leave the atmosphere they

a. can never go into orbit around the earth.

b. always come back to the earth.

c. can never return to the earth.

17 At 3:30 P.M. a swimming pool contains 2000 gallons of water. At 4:00 P.M. it contains 2500 gallons of water. The *rate* of change in the amount of water in the pool is

a. + 2000 gal/hr.

b. +1000 gal/hr.

c. - 500 gal/hr.

d. -1000 gal/hr.

e. + 500 gal/hr.

18 If an object accelerates from rest at the constant rate of $10\,\mathrm{m/s^2}$, what will be its velocity after six seconds?

a. $30\,\mathrm{m/s}$.

b. $10\,\mathrm{m/s}$.

c. $180\,\mathrm{m/s}$.

d. $60\,\mathrm{m/s}$.

19 An anvil that weighs 300 pounds is dropped at the same time as a hammer that weighs 10 pounds. Assuming that both objects are dropped from the same height and air resistance can be neglected, which of the following statements would currently accepted ideas predict?

a. The hammer and anvil hit the ground almost together.

b. The anvil hits the ground long before the hammer.

c. The hammer hits the ground long before the anvil.

20 At 5:00 p.m., a truck is 30 miles from Richmond. At 7:00 p.m., the truck is 120 miles from Richmond. Calculate the truck's average velocity component away from Richmond.

a. +45 mi/hr.

b. -45 mi/hr.

c. -75 mi/hr.

d. +90 mi/hr.

e. +75 mi/hr.

21 It is the year 2040 and you are participating in the tenth annual lunar skeet shoot. As a clay pigeon comes flying up from behind one of the moon's craters, you raise your magnetic rifle, aim, and let fly with an iron slug. Since there is no air on the moon, you can count on the uncomplicated laws of projectile motion that you learned in physics class. Suppose that the pigeon is thrown straight up and you fire at the instant it stops moving upward. In order to hit the pigeon, you should aim

a. at the point where you expect the pigeon's fall to take it by the time the slug gets there.

b. directly at the pigeon.

c. above the pigeon to compensate for the fall of the slug.

22 A ball is thrown straight up. It turns out to be convenient to measure distance upward from the top of its trajectory. Which of the following values might describe the position of the ball when it starts its trip?

a. $h = 0$.

b. $h = +2\,\mathrm{m}$.

c. $h = -2\,\mathrm{m}$.

23 All of the tests performed on a suspect's DNA show it to be the same as DNA from the scene of a crime. Which of the following conclusions is correct?

a. The suspect was definitely at the scene.

b. The suspect was probably at the scene.

c. The suspect could not have been at the scene.

d. The lab messed up the tests.

24 The speed of a rocket will increase whenever the rocket's acceleration vector

a. is not zero.

b. is in the opposite direction to the rocket's velocity vector.

c. is zero.

d. is in the same direction as the rocket's velocity vector.

25 A cannon shoots a shell straight up at an initial velocity of $300\mathrm{m/s}$. If air resistance can be neglected, how long will it take the shell to go up and come back down?

a. $30\,\mathrm{s}$.

b. $20\,\mathrm{s}$.

c. $60\,\mathrm{s}$.

d. $300\,\mathrm{s}$.

e. $500\,\mathrm{s}$.

26 Suppose you know how far your car has traveled at various times:

10 mi	at 6:00am	250 mi	at 1:00pm
15 mi	at 8:00am	280 mi	at 3:00pm
100 mi	at 10:00am	500 mi	at 6:00pm
150 mi	at 11:00am	560 mi	at 7:00pm

The best approximation to the instantaneous velocity of the car at 2:00pm is given by the average rate of change of the distance during the interval

a. from 10:00am to 3:00pm
b. from 10:00am to 11:00am.
c. from 1:00pm to 3:00pm.
d. from 11:00am. to 1:00pm
e. from 6:00am to 7:00pm

27 A cannon shoots a shell up with an initial vertical velocity component of 500m/s and an initial horizontal component of 400m/s. Neglecting air resistance and the curvature of the Earth, how far away from the cannon will the shell hit?

a. 40,000m.

b. 50,000m.

c. 80,000m.

d. 20,000m.

28 Galileo's Law of Inertia implies that the acceleration vector of an object that is not under any outside influence must be

a. perpendicular to the velocity vector.
b. pointing downward.
c. parallel to the velocity vector.
d. zero.
e. constant.

Answer Key: Fall 2007 PHX1M

1 Choice d. (the velocity vector and the acceleration vector can each be anything.)

2 Choice c. (does not require a force to keep moving.)

3 Choice d. (0 m/s.)

4 Choice c. ($+10\mathrm{m/s}^2$.)

5 Choice d. (test the predictions of the established theory.)

6 Choice c. (points in the same direction.)

7 Choice c. (-1000 gal/hr.)

8 Choice d. (5mi/hr.)

9 Choice d. (The Minoans were the first civilization on Crete.)

10 Choice c. (45 degrees from the horizontal.)

11 Choice d. ($30\,\mathrm{m/s}$.)

12 Choice b. (it is still directly over the dolphin and hits the poor creature.)

13 Choice b. (creating simplified events.)

14 Choice c. ($5\,\mathrm{m/s}$.)

15 Choice b. (towards the Sun.)

16 Choice a. (can never go into orbit around the earth.)

17 Choice b. (+1000 gal/hr.)

18 Choice d. ($60\,\mathrm{m/s}$.)

19 Choice a. (The hammer and anvil hit the ground almost together.)

20 Choice a. (+45 mi/hr.)

21 Choice b. (directly at the pigeon.)

22 Choice c. ($h = -2\,\mathrm{m}$.)

23 Choice b. (The suspect was probably at the scene.)

24 Choice d. (is in the same direction as the rocket's velocity vector.)

25 Choice c. ($60\,\mathrm{s}$.)

26 Choice c. (from 1:00pm to 3:00pm.)

27 Choice a. (40,000m.)

28 Choice d. (zero.)

Solutions

1 Module 009 The Acceleration Vector: Question 2.5

2 Module 005 The law of inertia.: Question 3A

3 Module 007 Instantaneous Rate of Change: Question 5.4

4 Module 009 Components of Acceleration: Question 1.5

5 Module 010 Universality of Free-fall: Question 3.1

6 Module 008 The Velocity Vector: Question 2N

7 Module 007 Negative Rate of Change Question 4N

8 Module 008 Speed: Question 3.4

9 Module 001 How to test a statement : Question 2A

10 Module 013 Projectile Motion: Question 3.3

11 Module 012 Constant Acceleration: Question 2.1

12 Module 013 Projectile Motion: Question 1.2

13 Module 005 Active experiments are needed. : Question 2N

14 Module 012 Constant Acceleration: Question 3.3

15 Module 009 Acceleration and Speed: Circular Motion: Question 4N

16 Module 013 Projectile Motion: Question 5.2

17 Module 007 Average Rate of Change Question 3N

18 Module 012 Constant Acceleration: Question 1.3

19 Module 010 Universality of Free-fall: Question 2.2

20 Module 008 Components of Velocity: Question 1.6

21 Module 013 Projectile Motion: Question 2.3

22 Module 006 Negative distances are needed. Question 2A

23 Module 001 Scientific Proof: Question 1A

24 Module 009 Acceleration and Speed: Linear Motion: Question 3.3

25 Module 012 Constant Acceleration: Question 4.1

26 Module 007 Instantaneous Rate of Change: Question 51.5

27 Module 013 Projectile Motion: Question 4.1

28 Module 009 Components of Acceleration: Question 5A