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

a. reproducing ordinary events.
b. creating simplified events.
c. adding to ordinary events.
d. creating entirely new events.

2 You fall off a cliff on the Moon, where the acceleration due to gravity is $1.7\,\mathrm{m/s^2}$. How fast will you be falling after three seconds?

a. $1.7\,\mathrm{m/s}$.
b. $30\,\mathrm{m/s}$.
c. $5.1\,\mathrm{m/s}$.
d. $0.567\,\mathrm{m/s}$.
e. $60\,\mathrm{m/s}$.

3 You step on the gas in your car and feel the acceleration push you back into your seat. The acceleration vector of your car points

a. forwards.
b. sideways.
c. backwards.
d. upwards.

4 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.

5 An airplane buzzes an airfield. As it flies over, its distance from the ground at various times (measured in seconds from the start of its maneuver) are

400 feet	at 2 seconds	25 feet	at 7 seconds
200 feet	at 4 seconds	50 feet	at 8 seconds
50 feet	at 6 seconds	100 feet	at 9 seconds

Which of the following expressions gives the *best* approximation to the *instantaneous rate of change* of the distance from the ground at 5 seconds from the start of the maneuver?

a. (50-200)/(6-4) ft/s.
b. (25-200)/(7-4) ft/s.
c. (50-200)/(8-4) ft/s.
d. (50-400)/(8-2) ft/s.
e. (50-400)/(6-2) ft/s.

6 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. +1000 gal/hr.

b. - 500 gal/hr.

c. -1000 gal/hr.

d. + 500 gal/hr.

e. + 2500 gal/hr.

7 Galileo set the pattern for how natural science works. According to this pattern, a new theory can replace an established theory when

a. the new theory is proven to be correct.

b. a prediction of the new theory passes experimental tests.

c. the old theory goes out of fashion.

d. the new theory is shown to be more elegant.

e. a prediction of the old theory fails experimental tests.

8 A ball is thrown straight upward and reaches its highest point (20 meters above its starting point) after two seconds and then starts to fall back down. What is its instantaneous velocity at the instant it reaches its highest point?

a. 0 m/s.

b. +10 m/s.

c. -40 m/s.

d. +40 m/s.

e. -10 m/s.

9 At a particular instant of time,

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

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

c. the velocity vector equals the acceleration vector.

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

10 A jet plane (sometimes called the Vomit Comet) is supposed to provide the sensation of being weightless by accelerating downward at $9.8\mathrm{m/s}^2$. It accomplishes this purpose by following an arc that changes its rate of climb (the rate of increase in its distance above sea level). Which of the following situations will provide the desired downward acceleration?

a. Rate of climb changes from $-4.9\mathrm{m/s}^2$ to $+4.9\mathrm{m/s}^2$ in one second.

b. rate of climb changes from $+9.8\mathrm{m/s}^2$ to $-9.8\mathrm{m/s}^2$ in one second.

c. rate of climb changes from $-9.8\mathrm{m/s}^2$ to $+9.8\mathrm{m/s}^2$ in one second.

d. rate of climb changes from $-4.9\mathrm{m/s}^2$ to $-9.8\mathrm{m/s}^2$ in one second.

e. Rate of climb changes from $+4.9\mathrm{m/s}^2$ to $-4.9\mathrm{m/s}^2$ in one second.

11 Which of the following is a scientific statement (as defined by Popper)?

a. There is intelligent life on other stars.

b. The Moon is made entirely of blue cheese.

c. There is beauty in a sunset.

d. Isaac Newton was the greatest scientist.

12 It is the year 2060 and you are participating in the 30th annual lunar skeet shoot. As a clay pigeon comes flying up from behind one of the moon's craters, you trigger your computerized magnetic rifle 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. Your rifle is aimed by a computer that is designed to operate in open space where there is no gravity to contend with. Thus it aims at a point ahead of the pigeon where a straight-line path would predict it to be when the slug arrives. The computer does not take the moon's gravity into account and does not know that the pigeon is actually following a curved trajectory.

a. your slug always flies below the pigeon.
b. your slug always flies above the pigeon.
c. you hit the pigeon anyway.

13 It takes thirty minutes to run twenty gallons of water into a tub. What is the *rate* of change of the water in the tub?

a. +3/2 min/gal.
b. +20 gal/min.
c. -2/3 gal/min.
d. +2/3 gal/min.
e. -3/2 min/gal.

14 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 return to the earth.
b. can never go into orbit around the earth.
c. always come back to the earth.

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

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

16 Galileo asserted that a moving object

a. always come to rest eventually.
b. does not require a force to keep moving.
c. requires a force to keep moving.

17 Aristotle thought that

a. Heavier objects would fall faster than lighter objects.
b. Heavier objects and lighter objects would fall at about the same speed.
c. The speed of an objects fall depended on its size.
d. Lighter objects would fall faster than heavier objects.

18 A cannon shoots a shell straight up at an initial velocity of 250m/s. If air resistance can be neglected, how long will it take the shell to go up and come back down?

a. $50\,\mathrm{s}$.

b. $25\,\mathrm{s}$.

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

d. $250\,\mathrm{s}$.

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

19 Take the Earth as a fixed reference point. As the Moon moves around the Earth, the Moon's acceleration vector then points

a. towards the Earth.

b. towards the Sun.

c. away from the Earth.

d. nowhere because it's zero.

e. in its direction of motion.

20 Suppose that a baseball is thrown with a horizontal velocity component of 30 m/s (about 66 miles per hour which is not too difficult) and a vertical velocity component of 10m/s. How far will it travel before coming back down to the level at which it was thrown?

a. 20m.

b. 10m.

c. 60m.

d. 80m.

e. 30m.

21 A ball is thrown straight up. It turns out to be convenient to measure time from the instant that it reaches the top of its trajectory. Which of the following values might describe the instant that it starts its trip?

a. $t = -2\,\mathrm{s}$.

b. $t = 0\,\mathrm{s}$.

c. $t = +2\,\mathrm{s}$.

22 Suppose that a car that is moving North is said to have a velocity component of 50 miles per hour. For North-South distances measured in the same way, a car with a velocity component of -50 mph *must* then be moving

a. West.

b. South.

c. North.

d. East.

23 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. 45 degrees from the horizontal.

b. 0 degrees from horizontal.

c. 60 from the horizontal.

d. 20 degrees from the horizontal.

e. 30 degrees from the horizontal.

24 Which one of the following statements about the Theory of Evolution is definitely wrong?

a. The Theory is wrong.

b. The Theory is a proven fact.

c. The Theory has not yet been disproved.

d. The Theory is well-established.

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

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

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

26 A ball is thrown straight up and takes two seconds to reach its maximum altitude. How fast was it thrown?

a. $2\,\mathrm{m/s}$.

b. $400\,\mathrm{m/s}$.

c. $40\,\mathrm{m/s}$.

d. $20\,\mathrm{m/s}$.

e. $4\,\mathrm{m/s}$.

27 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. $5\,\mathrm{m/s}$.

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

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

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

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

28 If all of the velocity components of an object stay the same, the object's velocity vector will

a. keep the same direction but might change length.

b. stay the same in both length and direction.

c. keep the same length but might change direction.

d. increase in length at a constant rate.

Answers

1 Choice b. (creating simplified events.)

2 Choice c. ($5.1\,\mathrm{m/\,s}$.)

3 Choice a. (forwards.)

4 Choice d. (5mi/hr.)

5 Choice a. ((50-200)/(6-4) ft/s.)

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

7 Choice e. (a prediction of the old theory fails experimental tests.)

8 Choice a. (0 m/s.)

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

10 Choice e. (Rate of climb changes from $+4.9$m/s^2 to -4.9m/s^2 in one second.)

11 Choice b. (The Moon is made entirely of blue cheese.)

12 Choice c. (you hit the pigeon anyway.)

13 Choice d. (+2/3 gal/min.)

14 Choice b. (can never go into orbit around the earth.)

15 Choice a. (zero.)

16 Choice b. (does not require a force to keep moving.)

17 Choice a. (Heavier objects would fall faster than lighter objects.)

18 Choice a. ($50\,\mathrm{s}$.)

19 Choice a. (towards the Earth.)

20 Choice c. (60m.)

21 Choice a. ($t = -2\,\mathrm{s}$.)

22 Choice b. (South.)

23 Choice a. (45 degrees from the horizontal.)

24 Choice b. (The Theory is a proven fact.)

25 Choice a. (it is still directly over the dolphin and hits the poor creature.)

26 Choice d. ($20\,\mathrm{m/\,s}$.)

27 Choice a. ($5\,\mathrm{m/\,s}$.)

28 Choice b. (stay the same in both length and direction.)

Solutions

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

2 Module 012 Constant Acceleration: Question 1.5

3 Module 009 Acceleration and Speed: Linear Motion: Question 3N

4 Module 008 Speed: Question 3.4

5 Module 007 Instantaneous Rate of Change: Question 51N

6 Module 007 Negative Rate of Change Question 4N

7 Module 010 Universality of Free-fall: Question 3.3

8 Module 007 Instantaneous Rate of Change: Question 5.5

9 Module 009 The Acceleration Vector: Question 2.5

10 Module 009 Components of Acceleration: Question 1.6

11 Module 001 How to test a statement : Question 2N

12 Module 013 Projectile Motion: Question 2.1

13 Module 007 Average Rate of Change Question 3.6

14 Module 013 Projectile Motion: Question 5.2

15 Module 009 Components of Acceleration: Question 5A

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

17 Module 010 Universality of Free-fall: Question 1.2

18 Module 012 Constant Acceleration: Question 4.2

19 Module 009 Acceleration and Speed: Circular Motion: Question 4.3

20 Module 013 Projectile Motion: Question 4.2

21 Module 006 Negative times are needed. Question 3B

22 Module 008 Components of Velocity: Question 1.4

23 Module 013 Projectile Motion: Question 3.3

24 Module 001 Scientific Proof: Question 1N

25 Module 013 Projectile Motion: Question 1.2

26 Module 012 Constant Acceleration: Question 2.4

27 Module 012 Constant Acceleration: Question 3.3

28 Module 008 The Velocity Vector: Question 2A