1) According to Kepler's laws, the paths of planets about the sun are
A) parabolas.
B) circles.
C) straight lines.
D) ellipses.
E) none of these
Answer: D

2) Which of the following is not a vector quantity?
A) velocity
B) speed
C) acceleration
D) None are vector quantities.
E) All are vector quantities.
Answer: B

3) An airplane travels at 141 km/h toward the northeast. What is its component of velocity due north?
A) 41 km/h
B) 100 km/h
C) 110 km/h
D) 141 km/h
Answer: B

4) A rock is thrown upward at 50 degrees with respect to the horizontal. As it rises, neglecting air drag, its horizontal component of velocity
A) increases.
B) remains unchanged.
C) decreases.
Answer: B

5) Throw an object upward at a 45 degree angle. With no gravity it will follow a straight-line path. But because of gravity, at the end of 1 second, it is
A) about 5 m below the straight line.
B) about 10 m below the straight line.
C) about 15 m below the straight line.
Answer: A

6) A bullet fired horizontally from a rifle begins to fall
A) as soon as it leaves the barrel.
B) after air friction reduces its speed.
C) neither of these
Answer: A

7) An Earth satellite is simply a projectile
A) freely falling around the Earth.
B) floating motionless in space near the Earth.
C) approaching the Earth from outer space.
Answer:  A

8) A projectile is fired horizontally in a region of no air resistance. The projectile maintains its horizontal component of velocity because
A) it is not acted on by any forces.
B) it is not acted on by any horizontal forces.
C) it has no vertical component of velocity to begin with.
D) the net force acting on it is zero.
E) none of these
Answer:  B

9) A hunter on level ground fires a bullet at an angle of 2 degrees below the horizontal while simultaneously dropping another bullet from the level of the rifle. Which bullet will hit the ground first?
A) the dropped one
B) the fired one
C) Both hit at the same time.
Answer:  B

10) An object is dropped and freely falls to the ground with an acceleration of 1 g. If it is thrown upward at an angle instead, its acceleration will be
A) 0 g.
B) 1 g downward.
C) 1 g upward.
D) larger than 1 g.
E) none of these
Answer:  B

11) A projectile is fired into the air at an angle of 50 degrees with the ground and lands on a target that is at the same level at which the projectile started. It will also land on the target if it is fired at an angle of
A) 40 degrees.
B) 45 degrees.
C) 55 degrees.
D) 60 degrees.
E) none of these
Answer:  A

12) Two projectiles are fired from ground level at equal speeds but different angles. One is fired at an angle of 30 degrees and the other at 60 degrees. The projectile to hit the ground first will be the one fired at (neglect air resistance)
A) 30 degrees.
B) 60 degrees.
C) Both hit at the same time.
13) A projectile is fired vertically from the surface of the Earth at 8 km/s. The projectile will
A) go into circular orbit about the Earth.
B) rise and fall back to the Earth's surface.
C) follow an uncertain path.
D) escape from the Earth.
Answer: B

14) Without air resistance, a projectile fired horizontally at 8 km/s from atop a mountain would
A) accelerate downward at g as it moves horizontally.
B) trace a curve that matches the earth's curvature.
C) return later to its starting position and repeat its falling behavior.
D) all of these
E) none of these
Answer: D

15) An object is thrown vertically into the air. Because of air resistance, the time for its descent
will be
A) longer than the ascent time.
B) shorter than the ascent time.
C) equal to the ascent time.
D) Not enough information given to say.
Answer: A

16) An airplane flies at 40 m/s at an altitude of 50 meters. The pilot drops a heavy package which
falls to the ground. Where, approximately, does the package land relative to the plane's new
position?
A) beneath the plane
B) 400 m behind the plane
C) 500 m behind the plane
D) more than 500 m behind the plane
E) none of these
Answer: A

17) A river 100 m wide flows due south at 1 m/s. A boat that goes 1 m/s relative to the water is
pointed due east as it crosses from the west bank. The boat reaches the east bank
A) due east of where it started.
B) 141 m farther south than where it started.
C) 100 m farther south than where it started.
D) 100 m farther north than where it started.
Answer: C

18) A river 100 m wide flows due south. A boat that goes 1 m/s relative to the water is pointed
due east as it crosses from the west bank. The boat crosses in
A) 50 s.
B) 100 s.
C) 141 s.
D) 200 s.
Answer: B

Kepler’s Laws

1) The tangential velocity of an Earth satellite is its velocity
A) parallel to the surface of the Earth.
B) perpendicular to the surface of the Earth.
C) attributed to satellites moving in any direction.
Answer: A

2) If a satellite's radial velocity is zero at all times, its orbit must be
A) parabolic.
B) elliptical.
C) circular.
D) geosynchronous.
Answer: C

3) What prevents satellites such as the space shuttle from falling?
A) gravity
B) centripetal force
C) centrifugal force
D) the absence of air drag
E) Nothing; they are continually falling as they orbit the Earth.
Answer: E

4) An Earth satellite is in an elliptical orbit. The satellite travels fastest when it is
A) nearest the Earth.
B) farthest from the Earth.
C) It travels at constant speed everywhere in orbit.
Answer: A

5) It takes Pluto a longer time to orbit the sun than the Earth does because Pluto
A) has much further to go.
B) goes much slower.
C) Choices A and B are both correct.
D) none of the above
Answer: C

6) A "weightless" astronaut in an orbiting shuttle is
A) shielded from the Earth's gravitational field.
B) beyond the pull of gravity.
C) pulled only by gravitation to the shuttle which cancels the Earth's gravitational pull.
D) like the shuttle, pulled by Earth's gravitation.
E) none of these
Answer: D
7) A satellite describes an elliptical orbit about a planet. The satellite travels much faster when it is directly over a
   A) large ocean.
   B) large island.
   C) high mountain range.
   D) great plain or plateau.
   E) None of the above choices affects its speed very much.
   Answer: E

8) A lunar month is about 28 days. If the moon were farther from the Earth than it is now, the lunar month would be
   A) more than 28 days.
   B) less than 28 days.
   C) about 28 days.
   D) difficult to predict without much more information.
   Answer: A

9) The speeds of the planets about the sun depend on
   A) their distances from the sun.
   B) the masses of the planets.
   C) their periods of rotation.
   D) None of the above are correct.
   Answer: A

10) A vertically oriented rocket that is somehow able to maintain a continuous upward velocity of 8 km/s will
    A) escape from the Earth.
    B) be unable to escape the Earth.
    C) eventually maintain a fixed orbit around the sun.
    Answer: A

11) Minimal orbital speed about the Earth is about 8 km/s. Minimal orbital speed about the moon would be
    A) less than 8 km/s.
    B) more than 8 km/s.
    C) about 8 km/s.
    Answer: A

12) A satellite in an elliptical orbit travels at constant
    A) velocity.
    B) speed.
    C) acceleration.
    D) all of these
    E) none of these
    Answer: E
13) A satellite near the Earth makes a full circle in about an hour and a half. How long would a satellite located as far away as the moon take to orbit the Earth?
A) the same hour and a half
B) less than an hour and a half
C) about 28 days
D) More information about the satellite is needed.
E) none of these
Answer: C

14) Communications and weather satellites always appear at the same place in the sky. This is because these satellites are
A) beyond the pull of the Earth's gravitational field.
B) moving at a speed just short of escape velocity.
C) orbiting the Earth with a 24-hour period.
D) stationary in space.
E) none of these
Answer: C

15) Pioneer 10 was able to escape the solar system by
A) having a sufficient escape velocity at launch.
B) "bouncing off" Jupiter like a tennis ball bouncing off an approaching tennis racket.
C) refueling via solar cells.
D) nuclear-powered sustained thrust.
Answer: B

16) Rockets that launch satellites into orbit need less thrust when fired from
A) Cape Canaveral.
B) Edwards Air Force Base in California.
C) Hawaii.
D) Location does not bear on the required rocket thrust.
Answer: C

17) Angular momentum is conserved for a satellite in
A) circular orbit.
B) elliptical orbit.
C) both of these
D) neither of these
Answer: C

18) Angular momentum is greater for a satellite when it is at the
A) apogee.
B) perigee.
C) same at apogee and perigee
Answer: C

19) Which would require the greater energy: slowing down of the orbital speed of the Earth so it crashes into the sun, or speeding up the orbital speed of the Earth so it escapes the sun?
A) slowing down
B) speeding up
C) same each way
Answer: B