1) When a parachutist jumps from an airplane, he eventually reaches a constant speed, called the terminal velocity. This means that
   A) the acceleration is equal to \( g \).
   B) the force of air resistance is equal to zero N.
   C) the effect of gravity has died down.
   D) the force of air resistance is equal to the weight of the parachutist.
   Answer: D

2) A force of 120 N is applied to an object whose mass is 30 kg. The object's acceleration is
   A) 3600 m/s^2.
   B) 150 m/s^2.
   C) 4.0 m/s^2.
   D) 0.25 m/s^2.
   Answer: C

3) A 30.0-kg load is being lifted with constant speed using the ideal pulley arrangement shown in Figure. What is the magnitude of the force \( F \)?
   A) 147 N
   B) 25.7 N
   C) 384 N
   D) 390 N
   Answer: 147 N

4) A ball is thrown up into the air. At the highest point in its trajectory, the net force acting on it is
   A) equal to its weight.
   B) greater than its weight.
   C) less than its weight, but not zero N.
   D) zero N.
   Answer: A

5) A fireman is sliding down a fire pole. As he speeds up, he tightens his grip on the pole, thus increasing the vertical frictional force that the pole exerts on the fireman. When this force equals the weight of the fireman, what happens?
   A) The fireman comes to a stop.
   B) The fireman descends with slower and slower speed.
   C) The fireman descends with a smaller acceleration.
   D) The fireman continues to descend, but with constant speed.
   Answer: D

6) A person has a mass of 45 kg. How much does she weigh on the Moon, where \( g = 1.62 \text{ m/s}^2 \)?
   A) 45 N
   B) 73 N
   C) 7.4 N
   D) 440 N
   Answer: B

7) A 40.0-kg crate is being raised by means of a rope. Its upward acceleration is 2.00 m/s^2. What is the force exerted by the rope on the crate?
   A) 312 N
   B) 392 N
   C) 472 N
   D) 552 N
8) A 4.50-kg person steps on a scale in an elevator. The scale reads 460 N. What is the magnitude of the acceleration of the elevator?
A) 9.81 m/s²
B) 46.9 m/s²
C) 0.206 m/s²
D) 0.412 m/s²
Answer: D

9) What does the word "normal" mean in the phrase "normal force"?
A) the force that is usually exerted by a surface
B) the total force exerted by a surface
C) the component of the force exerted by a surface parallel to the surface
D) the component of the force exerted by a surface perpendicular to the surface
Answer: D

10) A 40.0-kg suitcase is being pulled along the ground by means of a strap which exerts a force of 10.0 N at an angle of 51.0° above the horizontal. What is the normal force exerted by the ground?
A) 17.1 N
B) 15.7 N
C) 384 N
D) 398 N
Answer: C

11) A 3.00-kg mass and a 5.00-kg mass hang vertically at the ends of a rope that goes over an ideal pulley. If the masses are released from rest, how long does it take for the 3.00-kg mass to rise by 1.00 m?
A) 0.407 s
B) 0.735 s
C) 0.815 s
D) 0.903 s
Answer: D

12) An object of weight $W$ is in free-fall close to the surface of Earth. What is the force that the object exerts on Earth?
A) A force greater than $W$
B) A force less than $W$
C) A force equal to $W$
D) No force at all
Answer: C

13) Two objects have masses $m$ and $5m$, respectively. They both are placed side by side on a frictionless inclined plane and allowed to slide down from rest.
A) It takes the lighter object 5 times longer to reach the bottom of the incline than the heavier.
B) It takes the heavier object 5 times longer to reach the bottom of the incline than the lighter.
C) The two objects reach the bottom of the incline at the same time.
D) You cannot predict in what order the two objects will reach the bottom of the incline.
Answer: C

14) A $m_1=3.0$-kg and a $m_2=5.0$-kg box rest side-by-side on a smooth, level floor. A horizontal force of 32 N is applied to the $m_1=3.0$-kg box pushing it against the $m_2=5.0$-kg box, and, as a result, both boxes slide along the floor. How large is the contact force between the two boxes?
A) 12 N
B) 20 N
C) 32 N
D) 0 N
Answer: B

15) In Figure above, masses $m_1$ and $m_2$ are such that $m_1 > m_2$ and they lay on a level, frictionless surface. We can apply a horizontal force $\vec{F}$ either from the left or from the right. The contact force between masses $m_1$ and $m_2$ is
A) larger when $\vec{F}$ is applied from the left.
B) larger when $\vec{F}$ is applied from the right.
C) the same in either case.
D) impossible to determine based on this data.
Answer: B

16) A 2-kg ball is moving with a constant speed of 5 m/s in a horizontal circle whose radius is 50 cm. What is the magnitude of the net force on the ball?
A) 0 N
B) 20 N
C) 40 N
D) 100 N
Answer: D

17) Refer to Figure below. Block A has a mass of $m_A=2.00$ kg and rests on a rough table and is connected to block B, which has a mass of $m_B=3.00$ kg, after passing over an ideal pulley, as shown. Block B is released from rest. The coefficient of kinetic friction between block A and the table is 0.300. What is the acceleration of the masses?
A) 3.92 m/s$^2$
B) 4.71 m/s$^2$
C) 5.89 m/s$^2$
D) 6.54 m/s$^2$
Answer: B

18) Refer to Figure below. Block A has a mass of 7.00 kg, block B has a mass of 5.00 kg and block C has a mass of 4.00 kg. The pulleys are ideal and there is no friction between block B and the table. What is the acceleration of the masses?
A) 0.981 m/s$^2$
B) 1.97 m/s$^2$
C) 1.84 m/s$^2$
D) 0 m/s$^2$
Answer: C

19) Refer to Figure below. Block A has a mass of 5.00 kg, block B has a mass of 3.00 kg and block C has a mass of 2.00 kg. The pulleys are ideal and there is no friction between block B and the table. What is the tension in the string connecting blocks A and B?
A) 13.7 N
B) 34.3 N
C) 25.5 N
D) 38.3 N
Answer: B

20) A person throws a ball horizontally from the top of a building that is 40.0 m high. The initial velocity of the ball is 100 m/s. What is the horizontal distance that the ball travels before hitting the ground?
A) 100 m
21) A rock is thrown at some angle above the horizontal with a certain velocity. It reaches its highest point and starts falling down. What is the magnitude of the acceleration of the rock just before it hits the ground?
   A) 0
   B) 9.8
   C) 19.6
   D) There is not enough information to answer the question.
   Answer: B

22) A rock is thrown upwards at an angle of 40° with respect to the horizontal. As the rock is rising in its trajectory, the vertical component of its velocity changes.
   A) increases.
   B) decreases.
   C) remains the same.
   D) None of the other choices is correct.
   Answer: B

23) A bullet is fired from ground level with a speed of 150 m/s at an angle 30.0° above the horizontal at a location where \( g = 10.0 \text{ m/s}^2 \). What is the vertical component of its velocity when it is at the highest point of its trajectory?
   A) 0 m/s
   B) 75.0 m/s
   C) 130 m/s
   D) 150 m/s
   Answer: A

24) A ball is thrown with a velocity of 40 m/s at an angle of 30° above the horizontal and attains a certain range \( R \). At what other angle will this ball attain the same range keeping its initial velocity the same?
   A) 15°
   B) 90°
   C) 120°
   D) 60°
   Answer: D

25) For general projectile motion, which statement is true when the projectile is at the highest point of its trajectory?
   A) Its acceleration is zero.
   B) Its velocity is perpendicular to the acceleration.
   C) Its velocity and acceleration are both zero.
   D) The horizontal and vertical components of its velocity are zero.
   Answer: B

26) A projectile is shot from the edge of a vertical cliff 60.0 m above the ocean. It has a speed of 100 m/s and is fired at an angle of 35.0° above the horizontal. How far from the foot of the vertical cliff does the projectile hit the water?
   A) 126 m
   B) 312 m
   C) 684 m
   D) 1080 m
   Answer: D
27) A child throws a ball with an initial speed of 8.00 m/s at an angle of 40.0° above the horizontal. The ball leaves her hand 1.00 m above the ground. At what angle below the horizontal does the ball approach the ground?
   A) 35.1°
   B) 38.6°
   C) 48.0°
   D) 40.0°
   Answer: C

28) An athlete participates in a discus throw competition during an Olympiad that takes place in a city where acceleration due to gravity is 9.80 m/s². He throws the discus with an initial velocity of 20.0 m/s at an angle of 30.0° above the horizontal. Neglecting the height of the discus at the point of release, what is the range of the discus?
   A) 35.3 m
   B) 20.4 m
   C) 40.0 m
   D) 60.0 m
   Answer: A

29) Marcia uses a bow to shoot an arrow with initial velocity of magnitude \( v_0 \) and at an angle \( \theta \) above the horizontal. When the arrow returns to the same height from which it started,
   A) the speed of the arrow is twice \( v_0 \).
   B) the speed of the arrow is 9.8 times larger than \( v_0 \).
   C) the speed of the arrow is again \( v_0 \).
   D) the speed of the arrow is \( \sqrt{2} v_0 \).
   Answer: C

30) A ball rolls over the edge of a table with a horizontal velocity \( v \) m/s. The height of the table is 1.6 m and the horizontal range of the ball from the base of the table is 20 m. What is the magnitude and direction of the ball's acceleration right after it leaves the table?
   A) 4.9 m/s² downward
   B) 0 m/s² downward
   C) 19.6 m/s² downward
   D) 9.8 m/s² downward
   Answer: D