1. How many words are in your physics textbook?
   a) $10^3$
   b) $10^5$
   c) $10^7$
   d) $10^9$

2. Circuits A and B are made from identical batteries and light bulbs. The light bulb at the bottom of the circuit
   a) does not glow in either circuit.
   b) is brighter in circuit A than in circuit B.
   c) is brighter in circuit B than in circuit A.
   d) has the same brightness in both circuit A and B.

3. On level ground, two balls are launched from ground level with identical initial speeds. One is launched at an angle of 30° to the horizontal and the other at an angle of 60° to the horizontal. They land at equal distances from the launch point (air resistance can be neglected).
   Now, suppose the ground is not level. Again, two identical balls are launched with identical initial speeds, in the downhill direction. One ball is launched at an angle of 30° to the horizontal. To land at the same position as the first ball, the second ball should be launched at an angle to the horizontal which is
   a) equal to 60°.
   b) greater than 60°.
   c) less than 60°.
   d) if the ground is not level, no launch angle other than 30° will give the same landing position.

4. A crane lowers a steel girder into place at a construction site. The girder moves with constant speed. Consider the work $W_g$ done by gravity and the work $W_T$ done by tension in the cable. Which of the following is correct?
   a) $W_g$ is negative and $W_T$ is negative
   b) $W_g$ is positive and $W_T$ is negative.
   c) $W_g$ and $W_T$ are both zero.
   d) $W_g$ is negative and $W_T$ is positive.
5. The graph below shows the position of an object moving in the xy-plane at equal time intervals.

Which of the following statements is correct? The object is

a) moving at a constant speed in the x-direction and speeding up in the y-direction.
b) speeding up in the x-direction and slowing down in the y-direction.
c) speeding up in the y-direction and slowing down in the x-direction.
d) speeding up in both the x and y directions.

6. A proton and an electron are held apart. The mass of a proton is approximately 1840 times the mass of an electron. Suppose they are released from rest simultaneously. If, after a certain time, the change in momentum of the proton is \( \Delta p \), what is the magnitude of the change in momentum of the electron?

\[
\begin{align*}
| \Delta p_p | &= 1840 \times | \Delta p_e | \\
| \Delta p_e | &= \frac{| \Delta p_p |}{1840}
\end{align*}
\]

a) 43 \( \Delta p \)
b) 1840 \( \Delta p \)
c) \( \Delta p / 1840 \)
d) \( \Delta p \)

7. A ball on a string swings in a vertical circle. At the highest point of the circle, the string is under tension, and exerts a downward force on the ball. The “reaction” to this force, in the sense of Newton’s third law, is

a) an upward force on the string.
b) the force of gravity on the ball.
c) an upward force on the ball due to its circular motion.
d) a downwards force on the ball due to its circular motion.
8. An entomologist stands in a dark room facing a very large concave mirror of focal length $f$ on a distant wall (the distance to the mirror is much larger than the focal length). From time to time, fireflies fly across from right to left between her and the mirror. If she watches the reflection of a firefly in the mirror, which way will the reflection appear to move, if the firefly is at position 1 (outside the focal point $F$), or at position 2 (between the mirror and the focal point)?

a) From left to right for firefly 1, right to left for firefly 2.
b) From right to left for firefly 1, left to right for firefly 2.
c) From left to right in both cases.
d) From right to left in both cases.

9. A toy train is pulled across a table by a string attached to the engine.

While the train is accelerating forward, how do the tensions in the strings compare?

a) $T_1 > T_2$
b) $T_1 = T_2$
c) $T_1 < T_2$
d) The tensions cannot be compared without knowing the relative masses of the cars.

10. Three weights of mass $3M$, $2M$, and $M$ are connected with massless strings and massless, frictionless pulleys as in the diagram below. When the system is released from rest, how do the individual weights move?

a) Weights $3M$ and $2M$ accelerate down, while $M$ accelerates up.
b) All three begin to accelerate downwards.
c) Weight $3M$ remains motionless, while $2M$ accelerates down, and $M$ accelerates up.
d) $3M$ accelerates down, while $M$ and $2M$ accelerate up.