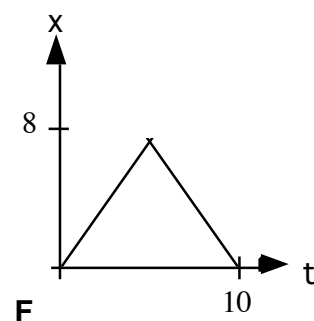
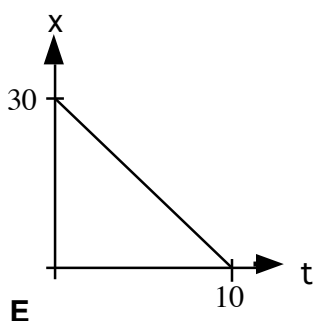
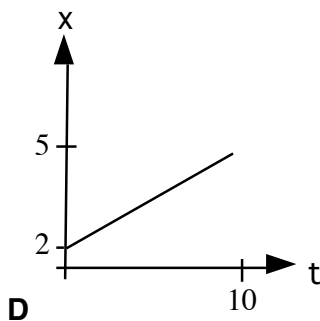
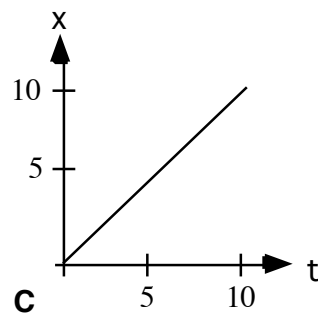
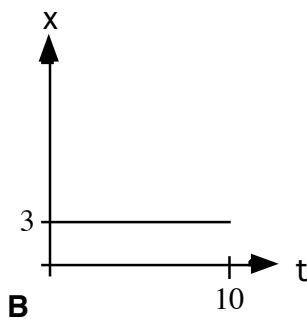
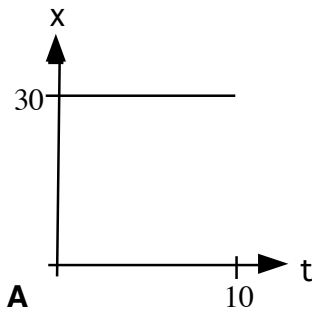


5. An object released from rest at time $t = 0$ slides down a frictionless incline a distance of 1 meter during the first second. The distance traveled by the object during the time interval from $t = 1$ second to $t = 2$ seconds is
(A) 1 m (B) 2 m (C) 3 m (D) 4m (E) 5 m
2. A 500-kilogram sports car accelerates uniformly from rest, reaching a speed of 30 meters per second in 6 seconds. During the 6 seconds, the car has traveled a distance of
(A) 15 m (B) 30 m (C) 60 m (D) 90 m (E) 180 m
1. In the absence of air friction, an object dropped near the surface of the Earth experiences a constant acceleration of about 9.8 m/s^2 . This means that the
(A) speed of the object increases 9.8 m/s during each second (B) speed of the object as it falls is 9.8 m/s
(C) object falls 9.8 meters during each second (D) object falls 9.8 meters during the first second only
(E) derivative of the distance with respect to time for the object equals 9.8 m/s^2
19. An object is shot vertically upward into the air with a positive initial velocity. Which of the following correctly describes the velocity and acceleration of the object at its maximum elevation?
- | <u>Velocity</u> | <u>Acceleration</u> |
|-----------------|---------------------|
| (A) Positive | Positive |
| (B) Zero | Zero |
| (C) Negative | Negative |
| (D) Zero | Negative |
| (E) Positive | Negative |

Position Time Graphs—Average Velocity

In the position vs. time graphs below, all the times are in seconds (s), and all the positions are in meters (m). Rank these graphs on the basis of which graph indicates the greatest average velocity where the average velocity is calculated from the beginning to the end of motion. Give the highest rank to the one(s) with the greatest average velocity & give the lowest rank to the one(s) indicating the least average velocity. If two graphs indicate the same average velocity give them the same rank.



Greatest 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ Least

Or, none of these are moving at all. _____

Or, the average velocity is the same for all of these. _____

Please carefully explain your reasoning.

How sure were you of your ranking? (circle one)

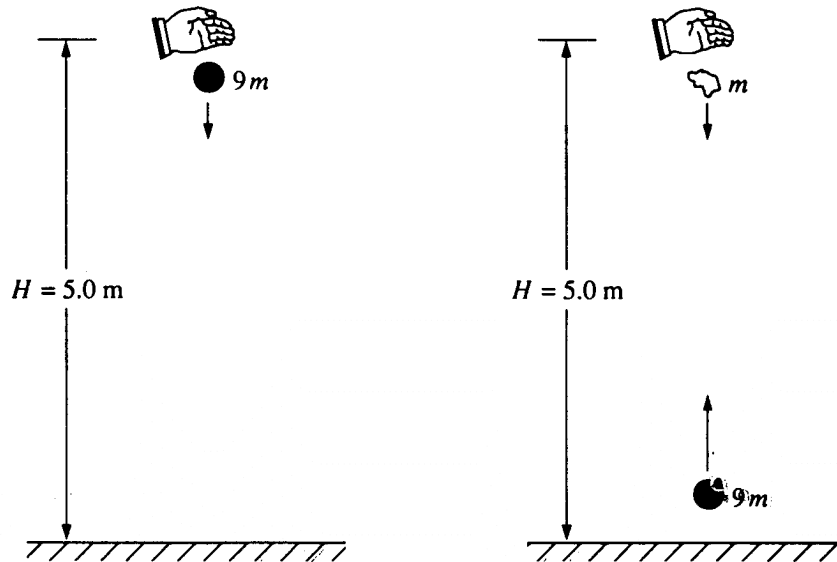
Basically Gessed

Sure

Very Sure

1 2 3 4 5 6 7 8 9 10

¹⁰ K. W. Nicholson



A ball of mass $9m$ is dropped from rest from a height $H = 5.0$ meters above the ground, as shown above on the left. It undergoes a perfectly elastic collision with the ground and rebounds. At the instant that the ball rebounds, a small blob of clay of mass m is released from rest from the original height H , directly above the ball, as shown above on the right. The clay blob, which is descending, eventually collides with the ball, which is ascending. Assume that $g = 10 \text{ m/s}^2$, that air resistance is negligible, and that the collision process takes negligible time.

- Determine the speed of the ball immediately before it hits the ground.
- Determine the time after the release of the clay blob at which the collision takes place.
- Determine the height above the ground at which the collision takes place.
- Determine the speeds of the ball and the clay blob immediately before the collision.
- If the ball and the clay blob stick together on impact, what is the magnitude and direction of their velocity immediately after the collision?

Hints Page

5. What was the average speed during the first second? If you know the start v was 0 and you know the average, you can get the final v for the first second. The you know the accel.

2. 500 kg is a distractor - just use Kinematics.

1. Instead of "meters per second squared", read the units of acceleration as "meters per second, every second"

19. Does gravity turn off at the top?

Ranking Task - Average Velocity: What is the definition of average velocity?

Free Response:

(a) The timeless equation.

(b) When they collide, what is true of their positions?

(c) Go back and plug your time into either the ball's or the clay's position equation.

(d) You have start v , time, and accel - find final v for each.

(e) This requires Conservation of Momentum, which we haven't done yet.

Answers Page

5. C

2. D

1. A

19. D

Ranking Task - Average Velocity:
greatest - C, D, [A, B, F], E - least

Free Response

(a) $y_0 = 5m$

$y = 0$

$a = -10m/s^2$

$v_0 = 0$

$v = ?$

$v^2 = v_0^2 + 2a\Delta y$

$v^2 = 0 + 2(-10)(-5)$

$v^2 = 100$

$v = 10m/s$

(b) *Ball*

$y_0 = 0$

$v_0 = 10m/s$ (rebounds with the same v as it hit with)

$a = -10m/s^2$

$y = ?$

$t = ?$

Clay

$y_0 = 5$

$v_0 = 0$

$a = -10m/s^2$

$y = ?$

$t = ?$

When they meet, they are at the same position at the same time.

Write their position equations and set them equal

Ball

$y = y_0 + v_0t + \frac{1}{2}at^2$

$y = 0 + 10t - 5t^2$

$0 + 10t - 5t^2 = 5 + 0 - 5t^2$

$10t - 5t^2 = 5 - 5t^2$

$10t = 5$

$t = 0.5\text{sec}$

Clay

$y = y_0 + v_0t + \frac{1}{2}at^2$

$y = 5 + 0 - 5t^2$

(c) $v = v_0 + at$

Ball

$v = 10 + (-10)(0.5)$

$v = 10 - 5$

$v = 5m/s$

Clay

$v = 0 + (-10)(0.5)$

$v = -5m/s$