Bard
A Place to Think

BHSEC Manhattan
Mr. Z / Physics

Name:
Date:

Physics Final Sample Review Questions

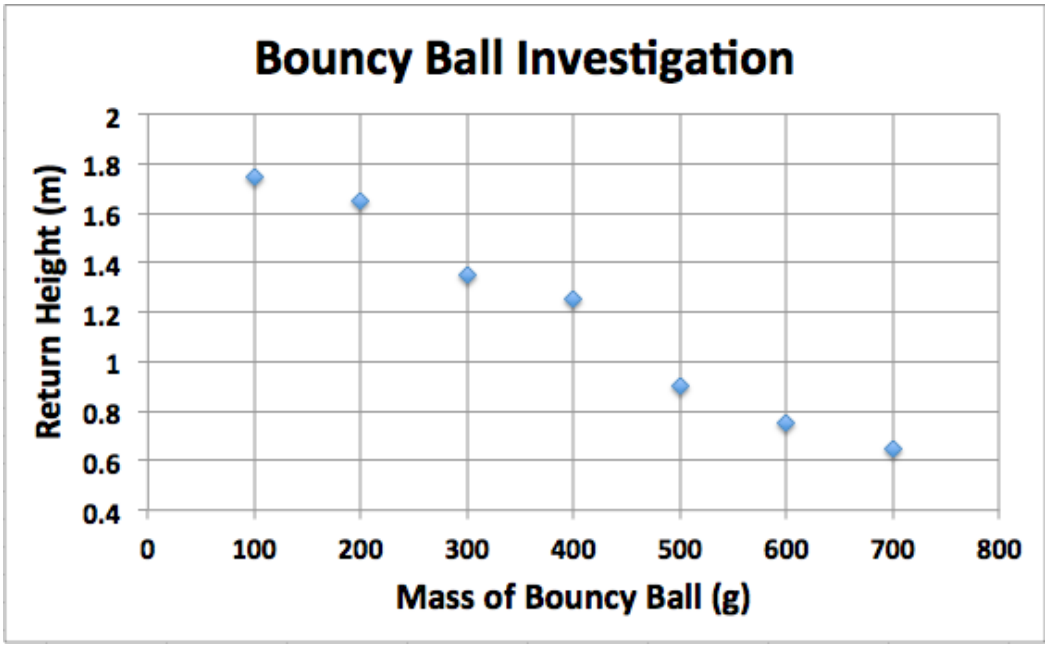
NOTE: This is not meant to be a complete study guide, just a random sampling of questions. You are responsible for all the material covered during the semester.

Unit Zero: Conversions & Mathematical Models for Linear Data

1. Make the following conversions:

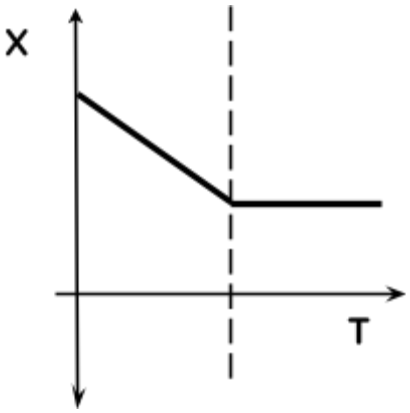
75 kg = _____ g 0.050 km = _____ in 30mi/hr = _____ m/s

2. Two students are investigating how changing the mass of a bouncy ball will affect how high the ball will bounce back to. They drop each ball from 2.0m above the ground. Below is the graph of the data they collected.
    a. Create the mathematical model for this data (use appropriate variables and units).
    b. Explain the meaning of the slope and y-intercept.
    c. Predict what mass the ball would need in order to bounce back to a height of 1m.
    d. Determine the x-intercept and explain what it means.



Unit One: Constant Velocity

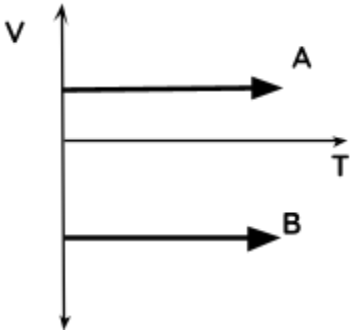
3. Describe the motion of this object:
   a. Initially the object is slowing down in the negative direction, and then stops.
   b. Initially the object is slowing down in the negative direction, and then moves at a constant speed.
   c. Initially the object moves at a negative constant velocity, and then it stands still.
   d. Initially the object is slowing down in the positive direction, and then moves at constant speed.



4. Which object is moving faster?

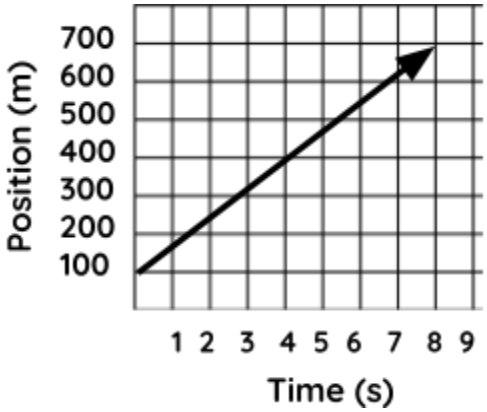
   a. Object A

   b. Object B



5. What is the velocity and acceleration of this vehicle:

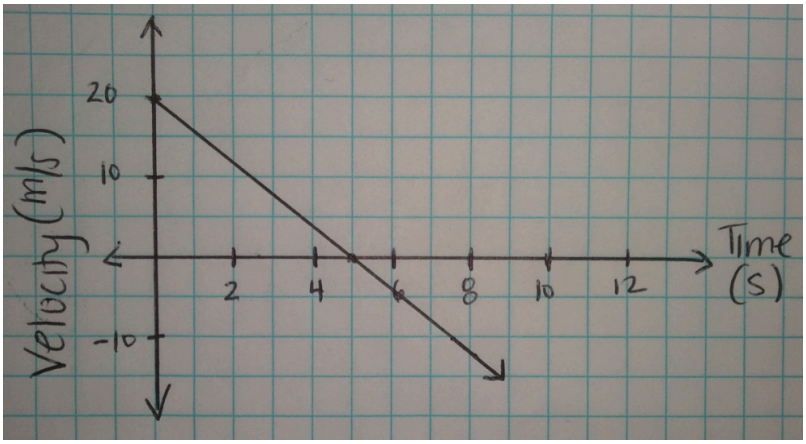
   a. 28 m/s; 2.8 m/s^2
   b. 75 m/s ; 0m/s^2
   c. 28 m/s ; 0m/s^2
   d. 0.036 m/s ; 0.0036 m/s



6. A skateboarder travels 40m at a constant speed of 3.5m/s. How much time does the skateboarder take to do this?
   a. 11.43s
   b. 0.0875s
   c. 140s

Unit Two: Uniform Acceleration

For Questions 7-12, refer the following Velocity-Time Graph:



7. Sketch the corresponding XT & AT Graphs.

8. Which of the following best describes the speed of the object:
   a. The object is moving at a constant negative velocity the entire time.
   b. The object slows down at a constant rate the entire time in the negative direction.
   c. The object slows down in the positive direction at first and then speeds up in the negative direction.
   d. The object speeds up in the positive direction at first then slows down in the negative direction.

9. What is the acceleration of the object?
   a. $0 m/s^2$
   b. $20 m/s^2$
   c. $-10 m/s^2$
   d. $-4 m/s^2$
   e. $-5 m/s^2$

10. What is the mathematical model for the velocity of this object? (Assume the object starts at the reference point.)

11. How much time will it take this object to reach a velocity of -33m/s?

12. What displacement does the object undergo between 2s and 8s?

13. An object is experiencing constant negative acceleration. Which of the following statements are true? Circle all that apply.
    a. It must be moving in the negative direction.
    b. It must be slowing down.
    c. The VT Graph has a negative slope.
    d. The PT Graph has a negative slope.
    e. Its velocity must be getting more negative.

14. A car, initially traveling 30.0m/s, experiences an acceleration of -6.0m/s^2. How far will it have traveled after 3.0s?
    a. 12 m
    b. 36 m
    c. 63 m
    d. 81m
    e. 90m

15. A plane, initially at rest, speeds up on a runway 500m long. If the plane must reach a takeoff speed of 90m/s by the end of the runway, what acceleration must the plane experience?
    a. 0.09m/s^2
    b. 0.18m/s^2
    c. 5.56m/s^2
    d. 8.1m/s^2

Unit Three: Forces, Equilibrium, and Net Force

16. A person hits a ball (0.6kg) with a bat (2.0kg). Circle your answer to the following questions.
    a. Which experiences a greater force? Ball / Bat / Same
    b. Which experiences a greater acc? Ball / Bat / Same

17. Recall the scenario of a student on roller blades in a subway car.
    a. Initially, both the car and the student are at rest. She does not hold onto anything (so reckless). The subway starts to move forward (North). What happens to the student? Explain and connect to one of Newton's Laws.
    b. Eventually, both the car and the student are moving forward (North) at a constant speed. The subway car then starts to pull into the station and slow down. What happens to the student? Explain and connect your explanation to one of Newton's Laws.

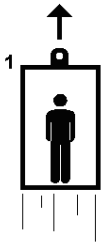
18. An object is known to be in equilibrium. Which of the following statements MUST be true:

    I. It experiences equal amounts of gravitational force and normal force.
    II. It is at rest.
    III. It is not accelerating.
    IV. It is experiences no unbalanced forces.

    a. I & II
    b. II & III
    c. I, III, & IV
    d. III & IV

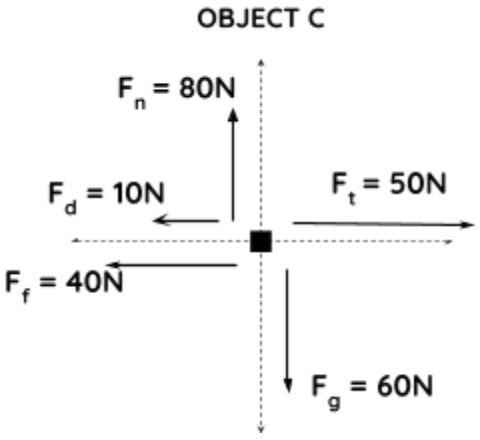
19. A person (70kg) stands in an elevator moving upward at a constant speed. How large of a normal force does the floor apply to the person?

    a. More than 700N
    b. Roughly 700N
    c. Less than 700N but more than 70N
    d. Roughly 70N

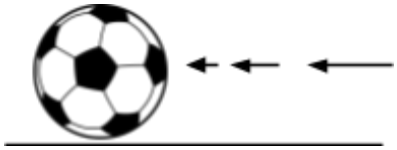


22. Write out the net force equation for each axis.

23. If Object C has a mass of 5kg, what acceleration does it experience?



24. Draw a FBD for a **soccer ball** that had previously been kicked is rolling to the left across the ground, slowing to a stop.



25. Draw a FBD for a car is moving at a constant velocity to the right.

Problem-Solving: Level II Problems

26. Mr. Z is going on a 5km jog (roughly 3mi). He runs at a constant 6m/s for the first 8.33mins, and then jogs at half that speed for the remainder of the trip. How much time, in total, does it take him to finish this jog?

27. While conducting an experiment, a student drops a ball from the top of his 3-story building, known to be 10m tall. Using a stopwatch, its found that the ball takes 1.41s to get to the ground. How fast is the ball moving just before it hits the ground?

28. A 4600 kg helicopter accelerates upward at 2.0 m/s^2. Determine the lift force exerted on the propellers by the air. Be sure to make a quantitative FBD and write force equation(s). (Assume no drag.)

29. A NASCAR racecar (mass of 700kg) is sitting at rest on a track. The driver then slams on the gas pedal. Traction between the tires and the ground results in 4500N of force on the car to push it forward. If the car experiences an acceleration of 5.0m/s^2, how much drag force does the car experience during this period?

    e. 1000N b. 3500N c. 900N d. 8000N

Level III Problems Involving Motion & Forces

31. A ball (400g) is dropped from the top of Bard. As it falls, it experiences 1.5N of drag. Bard is roughly 60ft tall. How much time will it take for the ball to reach the ground?

32. A person gets into an elevator car (0.82 tons) on the 1st floor. The elevator car, initially at rest, speeds up to its top speed in 4s as it ascends 13.1ft. How much tension force does the cable apply to the elevator car during this time? (Ignore drag.)

33. A car (1200kg) initially moving 22.4mi/hr needs to speed up as it gets onto a highway. The driver presses on the gas pedal, causing the car to experience 1800N of traction forward. The car also experiences 100N of drag and 200N of friction from the axles. If the driver holds down the gas pedal for 6s, how fast will the car be moving at the end of this time?