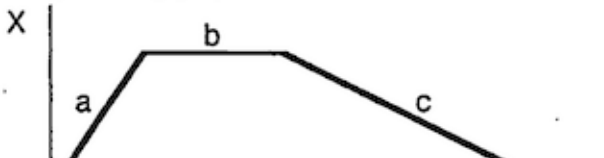
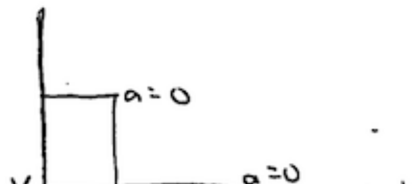
ABRHS PHYSICS (CP) NAME: Key

Linear Motion I Review

1. The slope of a position-time graph is velocity.
2. The slope of a velocity-time graph is acceleration.
3. What are the units of velocity? m/s What are the units of acceleration? m/s^2
4. What does it mean to have a constant speed?
   Travel the same distance every second
5. What does it mean to have a constant velocity?
   same AND in the same direction (straight line)
6. Is it possible to have a constant speed, yet your velocity be changing? Explain.
   Yes - if you are moving at the same rate (speed) but your direction changes
7. What does it mean to have a constant acceleration?
   Speed up (or slow down) at a constant rate (velocity changes the same amount every second).
8. If you have a constant acceleration of 15 km/h/s, what is happening?
   With each passing second, your velocity increases by 15km/h.
9. What is the difference between speed and velocity?
   Speed is distance travelled per unit time
   Velocity is distance travelled per unit time in a given direction
10. Is it possible to have a constant speed (1) and still be accelerating? How about a constant velocity (2)? Explain.
    (1) YES - As long as direction is changing, even if you have a constant speed, your velocity is changing therefore you are accelerating
    (2) NO - Constant velocity means acceleration is zero
11. Which of the following should be considered an "accelerator" in an automobile?
    a. Brake pedal. b. Gas pedal. c. Steering wheel. (d.) All of these.

Questions 12 to 14 refer to the following graph:





12. Over which interval(s) is the object moving in the positive direction? How about the negative direction?
    → a → c
13. Over which interval(s) is the object slowing down? How about speeding up?
    → none → none (no curves)
14. Over which interval(s) is the object's velocity and acceleration in the same direction?
    velocity is constant so a=0, so never (see picture)
15. Does the object have a velocity of zero over any interval?
    b

C

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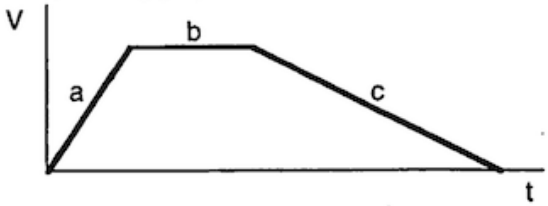
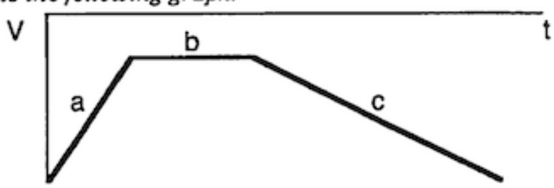
Questions 16 to 19 refer to the following graph:



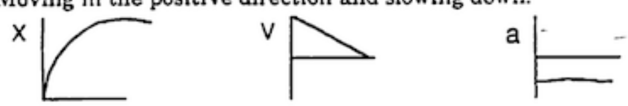
16. Over which interval(s) is the object moving in the positive direction? How about the negative direction?
    ↳ all ↳ none
17. Over which interval(s) is the object slowing down? How about speeding up?
    ↳ c ↳ a
18. Over which interval(s) is the object's velocity and acceleration in the same direction?
    ↳ a (both positive)
19. Does the object have a velocity of zero over any interval?
    no

Questions 20 to 23 refer to the following graph:

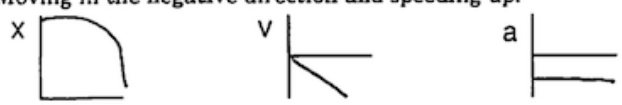


20. Over which interval(s) is the object moving in the positive direction? How about the negative direction?
    ↳ none ↳ all
21. Over which interval(s) is the object slowing down? How about speeding up?
    ↳ a ↳ c
22. Over which interval(s) is the object's velocity and acceleration in the same direction?
    c (both negative)
23. Does the object have a velocity of zero over any interval?
    no

24. If an object is moving in the negative direction (backwards) and speeding up, what is the direction of its acceleration?
    Negative- if it's speeding up, then the signs of velocity and acceleration should match
25. Sketch the following graphs (x vs. t, v vs. t, a vs. t)
    a. Moving in the positive direction and slowing down:



    b. Moving in the negative direction and speeding up:



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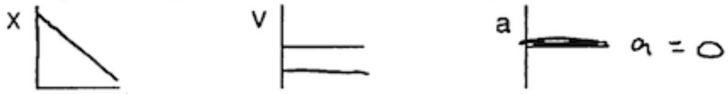
c. Moving in the negative direction at a constant speed:



d. Moving in the positive direction starting from rest, speeding up and then slowing down:

26. How long will it take a child running with a constant velocity of 3 m/s to cover a distance of 40 m? What is the child's acceleration over this distance?

a) $\frac{3m}{s} = \frac{40m}{x}$ $x = \boxed{13.3s}$

b) constant velocity ∴ no acceleration $\boxed{a = 0m/s^2}$

27. If you cover 100 m in 12 s. What is your average speed? Can you say anything about your instantaneous speed at exactly 4 seconds or at exactly the 75 m position?

$s = \frac{\Delta x}{t} = \frac{100m}{12s} = \boxed{8.3m/s}$

No - you don't know what the actual velocity is at any point - you only know the average

28. Sound travels at 340 m/s through the air. How long would it take you to hear a thunder clap that occurred 2 km away?

2km = 2000m

$\frac{340m}{s} = \frac{2000m}{x}$

$x = \boxed{5.88 \text{ seconds}}$

29. A car constantly accelerates from rest to 30 m/s in 6 seconds.

a. What was its acceleration?

$a = \frac{v_f - v_i}{\Delta t}$ $a = \frac{30-0}{6} = \boxed{5m/s^2}$

b. How many more seconds would it take to reach a speed of 50 m/s?

$a = \frac{v_f - v_i}{\Delta t}$ $5 = \frac{50-30}{t}$ $5t = 20$ $\boxed{t = 4s}$

30. If a skateboarder is moving with a speed of 10 m/s and slows down at a rate of 1.6 m/s².

a. How fast is the skateboarder moving 2 seconds later?

$a = \frac{v_f - v_i}{\Delta t}$ $-1.6 = \frac{v_f - 10}{2}$ $-3.2 = v_f - 10$ $\boxed{v_f = 6.8m/s}$

b. How many total seconds will it take the skateboarder to come to rest?

$a = \frac{v_f - v_i}{\Delta t}$ $-1.6 = \frac{0-10}{t}$ $-1.6 = \frac{-10}{t}$ $-1.6t = -10$

$\boxed{t = 6.25s}$

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31. A friend walks straight down a hallway. She first walks 100 meters at a constant speed of 1.5 m/s. Then she runs at 3 m/s for 30 seconds. What was her average speed for the entire motion?

$= \frac{\Delta x}{t}$ ① $1.5 = \frac{100}{t}$ $t = 66.7s$ $\bar{s} = \frac{\text{total dist}}{\text{total time}} = \frac{100 + 90}{66.7 + 30} = \frac{190}{96.7} = 1.96 m/s$

② $3 = \frac{d}{30}$ $d = 90m$

32. Starting from rest, a bike speeds up at a constant rate of 3 m/s every second. for 4 seconds.
    a. What is the acceleration of the bike?

$V_i = 0 m/s$ $a = 3 m/s^2$

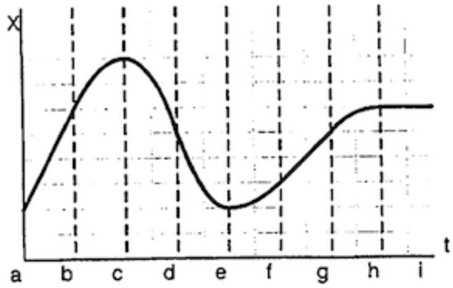
$a = 3 m/s^2$

$t = 4s$

    b. How fast is the bike going at the end of the 4 seconds?

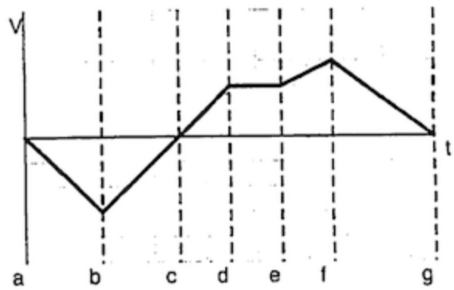
$a = \frac{V_F - V_i}{\Delta t}$ $3 = \frac{V_F - 0}{4}$ $12 = V_F$ $= 12 m/s$

33. For the position vs time graph to the right:



    a. Where is the object at rest?
    H – I & points C & E
    b. Where is the object going forwards?
    A – C, E – H
    c. Where is the object going backwards?
    C – E
    d. Where is the object speeding up?
    C – D, E – F
    e. Where is the object slowing down?
    B – C, D – E, G – H

34. For the velocity vs time graph to the right:



    a. Where is the object at rest?
    A, C, G (points)
    b. Where is the object going forwards?
    C – G
    c. Where is the object going backwards?
    A – C
    d. Where is the object speeding up?
    A – B, C – D, E – F
    e. Where is the object slowing down?
    B – C, F – G
    f. Where is the acceleration positive?
    B – D, E – F
    g. Where is the acceleration negative?
    A – B, F – G