If you're having trouble with dimensions of length...

1

Welcome to PHYS 1021!

2

Basics of PHYS 1021

- Jerry Feldman – Instructor
- Eliza Neights – Teaching Assistant
- TBA – Learning Assistant

- Material to be covered
  - Motion and Kinematics (Chaps. 1-4)
  - Forces and Dynamics (Chaps. 5-8 and 13a)
  - Energy and Momentum (Chaps. 9-11 and 13b)
  - Rotational Motion and Torque (Chap. 12)
  - Fluids (Chap. 14)
  - Heat and Thermodynamics (Chaps. 18-21)

3

Course Components

- Homeworks
  - two "half-assignments" each week in Expert TA
- Warmups
  - short pre-class activity in Expert TA (every Mon. and Weds.)
- Quizzes
  - every Friday there will be a 20-minute quiz (but not this week)
- Exams
  - two mid-terms and one Final Exam (semi-cumulative)
- Labs
  - performed in groups, one lab report submitted per group
- ConcepTests in class
  - using iClicker

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This Week / Next Week

- Warmups #1 and #2a/2b for this week
  - due by 10 AM before Weds. class and Fri. class this week
  - after that, due by 10 AM before Mon. or Weds. class
- Homework #1 opened today
  - it is due on Sunday night (11:59 pm)
  - after that, we move to due dates on Wednesday and Sunday
- Quiz #1
  - our first 20-minute quiz will be NEXT Friday (not this week!)
- Help Sessions
  - first one is with me on Weds. evening (8-10 pm)
  - here is the Zoom link: https://zoom.us/j/2897909637

(passcode: 10112)

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Grading Scheme

Course Component	Scheme A	Scheme B
Exam 1	17%	15%
Exam 2	17%	15%
Final Exam (cumulative)	21%	25%
Weekly Quizzes	15%	
Homework	10%	
Lab Reports	10%	
Warmups	6%	
ConcepTests	4%	
Total	**100%**	

Extra credit opportunities

extra points on exams

drop lowest quiz

full credit homework = 85%

Grading scheme is absolute – your grade is entirely determined by your total points.

So helping others does not impact your own grade.

6

Things to Keep in Mind…

- My goal is for you to learn concepts and then apply them in problem solving – do not try to solve things by memorization.

Memorization is what we resort to when what we are learning makes no sense.

7

Things to Keep in Mind…

- My major goal is that you will learn concepts and then apply them – do not try to solve things by memorization.
- I want your input – if you have an idea, please tell me!
- I really do expect you to read the material before class and work through all the problems.
- I want you to leave the class understanding what we did. Please stay and talk if you feel confused!
- I would like to see as many of you as possible come to the Help Sessions. If you need to arrange a different time, let me know – we will see what can be figured out.
- I will try hard to remember your name, but that is not always 100% effective, so you may have to remind me.
- If you tell me something in person, I will forget. Please be sure to always back up communication with e-mail.

8

There are two big mistakes you can make in this course, which you really should make every effort to avoid…

- You need to make sure that you do not get behind! The pace is quite fast, and it will be difficult to catch up.
- You need to ask questions when you are confused about something. Do not remain stuck on a question that you don't really understand.

9

10

Chapter 1 – Concepts of Motion

- Motion diagrams
- Position, time, displacement
- Velocity
- Acceleration
- Motion in 1D
- Scientific notation, units, etc.

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Basic Concepts of Motion

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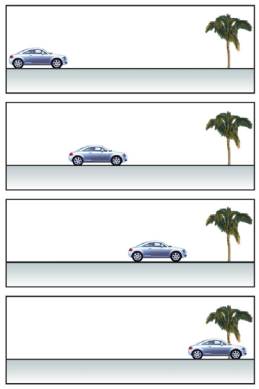
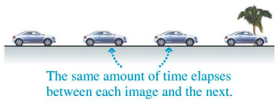
Motion Diagrams





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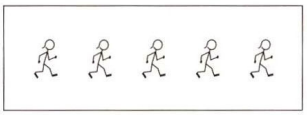
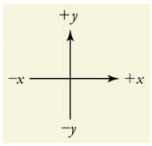
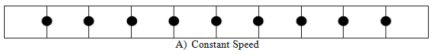
Motion Diagrams

What does this diagram represent?

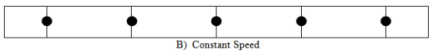




constant velocity



What's the difference?



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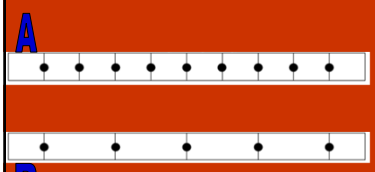
ConcepTest 1 Motion Diagrams

What is the relevant difference between the motion diagrams shown below?

1. A is accelerating, but B is not
2. both are const. speed but A is faster
3. A has more dots than B
4. A is moving to the right, but B is moving to the left
5. both are const. speed but A is slower

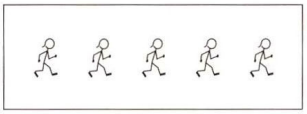


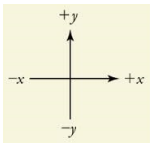
0 of 5

15

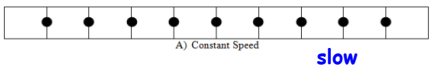
Motion Diagrams

What does this diagram represent?



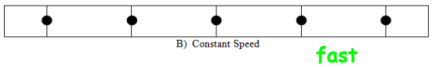


constant velocity



slow

What's the difference?



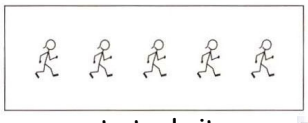
fast

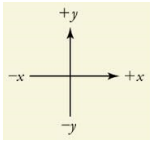
$$v = \frac{\Delta x}{\Delta t}$$

16

Motion Diagrams

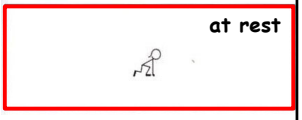
What does this diagram represent?





constant velocity

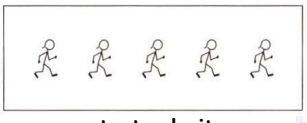
at rest

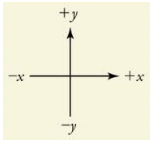


17

Motion Diagrams

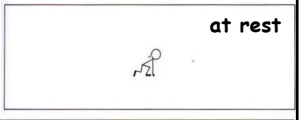
What does this diagram represent?

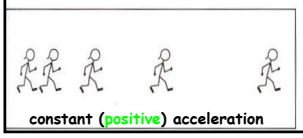




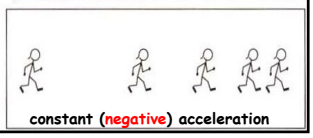
constant velocity

at rest





constant (positive) acceleration



constant (negative) acceleration

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Draw a motion diagram for each case below.
Use the particle model and display at least 8 dots.

1) A car accelerates forward from a stop sign.
It eventually reaches a steady speed of 45 mph.

2) A heavy rock is dropped over the edge of a cliff.

3) A skier starts from rest at the top of a 30° slope and steadily speeds up as she skis to the bottom.

4) Alice is driving at a steady 30 mph when the light ahead turns red. She slows down and stops.

19

Draw a motion diagram for each case below.
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1) A car accelerates forward from a stop sign.
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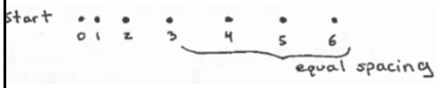
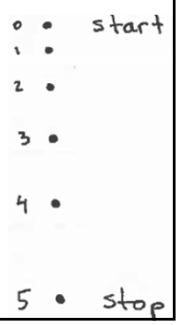
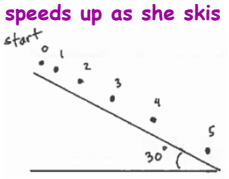


2) A heavy rock is dropped over the edge of a cliff.



20

Draw a motion diagram for each case below.
Use the particle model and display at least 8 dots.
3) A skier starts from rest at the top of a 30° slope and steadily speeds up as she skis to the bottom.



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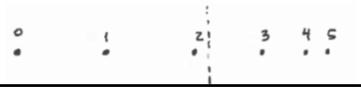
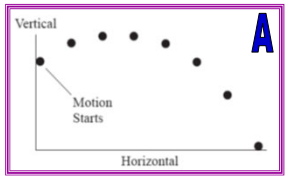
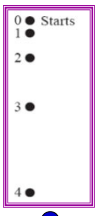
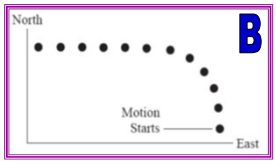


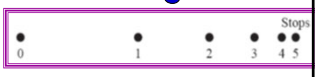
21

For each motion diagram, write down a description of the motion of the object. This should include names of specific objects and be phrased in common language.







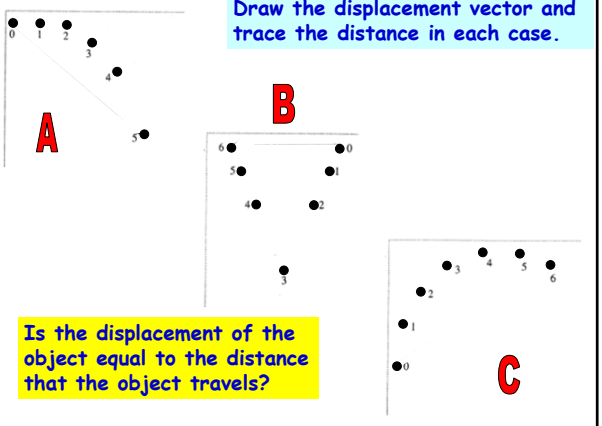


22

Displacement

23

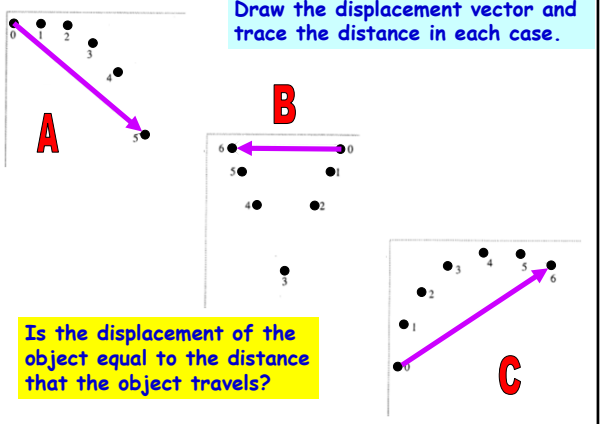
Draw the displacement vector and trace the distance in each case.



Is the displacement of the object equal to the distance that the object travels?

24

Draw the displacement vector and trace the distance in each case.



Is the displacement of the object equal to the distance that the object travels?

25

Displacement vs. Distance

What is the difference?

Which is which in this picture?

Can displacement ever equal distance?

Can it be greater or less than distance?

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Velocity

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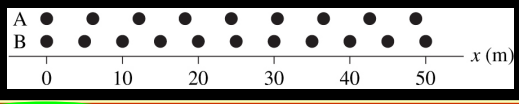
ConcepTest 1 **Motion Diagrams**

Two runners jog along a track. The positions are shown at 1 s time intervals. Which runner is moving faster?



1. runner A
2. runner B
3. both the same

$$v = \frac{\Delta x}{\Delta t}$$

Follow-up: What are the speeds of the runners?

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A bird flies a distance of 3 m in only 1/3 second.

1) What does the ratio 3/(1/3) tell you?

2) What does the ratio (1/3)/3 tell you?

3) How far would the bird fly in 1/10 second?

4) How long does it take the bird to fly 4 m?

29

Are you a night person?

Frank and Ernest

30

Chapter 2 – Kinematics in One Dimension

- Graphical representations of motion
- Uniform motion
- Instantaneous velocity
- Acceleration
- Motion with constant acceleration
  - ✓ solving 1D motion problems
  - ✓ free fall
  - ✓ motion on an inclined plane

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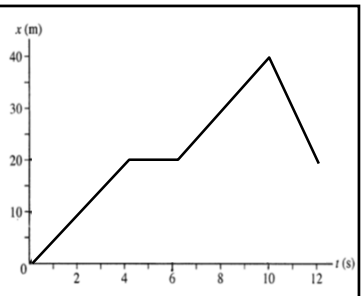
Graphical Representations

32

This x vs. t graph shows the position of an object moving in a straight line for 12 seconds.



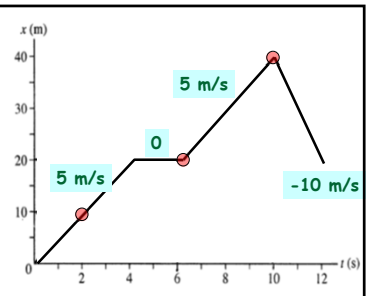
1) Find the position of the object at t = 2, t = 6, t = 10.

2) Find the velocity of the object during each stage.

33

This x vs. t graph shows the position of an object moving in a straight line for 12 seconds.

$$v = \frac{\Delta x}{\Delta t}$$



1) Find the position of the object at t = 2, t = 6, t = 10.

2) Find the velocity of the object during each stage.

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TACTICS BOX 2.1 Interpreting position-versus-time graphs

Information about motion can be obtained from position-versus-time graphs as follows:

1. Determine an object's *position* at time *t* by reading the graph at that instant of time.
2. Determine the object's *velocity* at time *t* by finding the slope of the position graph at that point. Steeper slopes correspond to faster speeds.
3. Determine the *direction of motion* by noting the sign of the slope. Positive slopes correspond to positive velocities and, hence, to motion to the right (or up). Negative slopes correspond to negative velocities and, hence, to motion to the left (or down).

Exercises 2,3

35

Let's check...

1) Draw x vs. t and v vs. t graphs for an object at rest at x = 5 m.

2) Draw x vs. t and v vs. t graphs for an object moving at a constant velocity of +3 m/s.

3) Draw #2 again, but for a velocity of -10 m/s.

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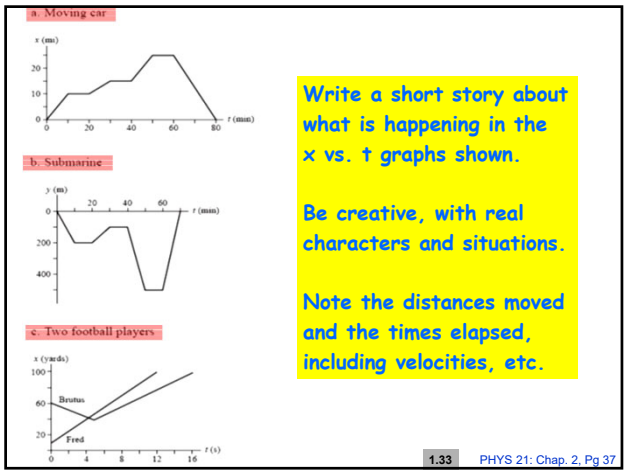

Write a short story about what is happening in the x vs. t graphs shown.

Be creative, with real characters and situations.

Note the distances moved and the times elapsed, including velocities, etc.

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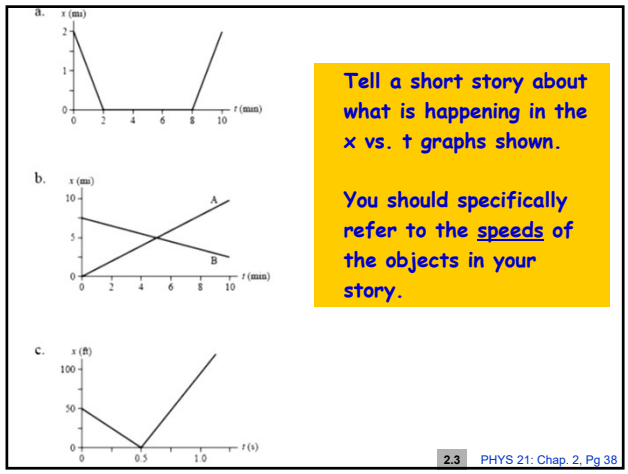

Tell a short story about what is happening in the x vs. t graphs shown.

You should specifically refer to the speeds of the objects in your story.

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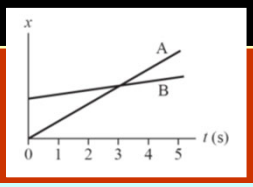
ConcepTest 3 Speed and Position

At time t = 1 s, how does the speed of object A compare to that of object B ?

1. $v_A > v_B$
2. $v_A = v_B$
3. $v_A < v_B$



Follow-up: Do objects A and B ever have the same speed? When?

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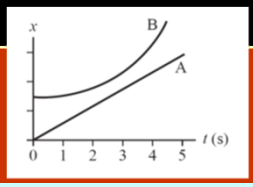
ConcepTest 4 Speed and Position

At time t = 1 s, how does the speed of object A compare to that of object B ?

1. $v_A > v_B$
2. $v_A = v_B$
3. $v_A < v_B$



Follow-up: Do objects A and B ever have the same speed? When?

0 of 5

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