

Name: Furroy Period: _____ Date: _____

1			2		
Property	SI Unit	abbreviation	Variable	Unit	Symbol
Mass	<u>gram</u>	<u>g</u>	Force	<u>Newton</u>	<u>F</u>
Time	<u>seconds</u>	<u>s</u>	Energy	<u>Joule</u>	<u>E</u>
Length	<u>meter</u>	<u>m</u>	Velocity	<u>m/s</u>	<u>V</u>
Volume	<u>liter</u>	<u>L</u>	Acceleration	<u>m/s²</u>	<u>a</u>
			Frequency	<u>Hertz</u>	<u>f</u>
			Work	<u>Joule</u>	<u>W</u>
			Power	<u>watt</u>	<u>P</u>

3	4
<p><u>Accuracy</u> is how close a measurement comes to its know of accepted value.</p> <p><u>Precision</u> the degree of exactness with which a measurement is made.</p> <p>(Accuracy, Precision)</p>	<p>Circle the measurement below with the most precision.</p> <p>1.325 1.3256 1.32568 <u>1.325688</u></p>

5
A 10.160 cm metal rod has been passed around to several groups of students. Each group is asked to measure the length of the rod. Each group has five students and each student independently measures the rod and records his or her result.

Student Group	Student 1	Student 2	Student 3	Student 4	Student 5
Group A	10.1	10.4	9.6	9.9	10.8
Group B	10.135	10.227	10.201	10.011	10.155
Group C	12.14	12.17	12.15	12.14	12.18
Group D	10.05	10.82	8.01	11.5	10.77
Group E	10	11	10	10	10

Which group has the most accurate measurement? Group E

Which group had the most precise measurement? Group B

Which Group had the smallest error? _____

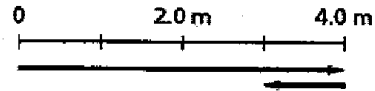
6

Tino is designing an experiment to investigate how sound waves are affected by the type of medium through which they travel. Which is the independent variable?

- a. frequency of waves
- b. speed of waves
- c. type of medium
- d. wavelength

7

The lines on the graph represent displacement vectors for the route along which a person moves.

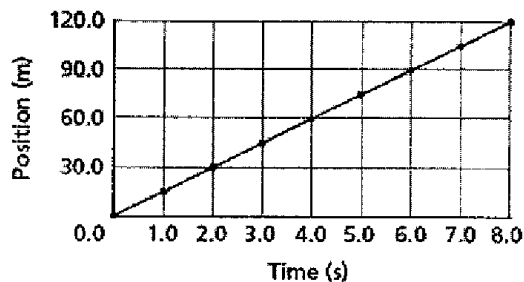


What is the person's displacement for the trip? **3m**

What is the total distance traveled? **5m**

8

The position-time graph represents part of a car trip along a straight road.



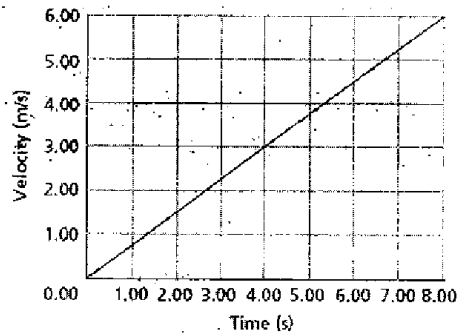
What is the average velocity of the car?

- a. 20 m/s
- b. 15 m/s
- c. 12 m/s
- d. 8 m/s

$$v_{avg} = \frac{d}{t} = \frac{120 \text{ m}}{8 \text{ s}} = 15 \text{ m/s}$$

9

The graph shows the velocity of a bicycle as the rider moves away from a curb.



Based on the slope of the graph, what is the average acceleration of the bicycle?

- A. 6.00 m/s²
- B. 3.00 m/s²
- C. 1.33 m/s²
- D. 0.750 m/s²

$$a = \frac{\Delta v}{\Delta t} = \frac{3 \text{ m/s}}{4 \text{ s}} = 0.75 \text{ m/s}^2$$

10 v_i

If a sprinter accelerates from rest at a constant rate of 2.0 m/s^2 , how fast will she be running after 4.0 s ?

- A. 8.0 m/s
 B. 4.0 m/s
 C. 2.0 m/s
 D. 0.5 m/s

$$a = \frac{v_f - v_i}{t}; v_f = a \cdot t$$

$$v_f = (2 \text{ m/s}^2)(4 \text{ s}) = 8 \text{ m/s}$$

11

A pebble falls from a bridge into the river below. If the pebble falls for 1.20 s , what is its velocity when it hits the water?

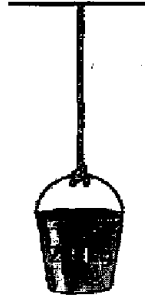
- A. 8.17 m/s
 B. 8.40 m/s
 C. 11.0 m/s
 D. 11.8 m/s

$$v_f = gt$$

$$= (9.81 \text{ m/s}^2)(1.2 \text{ s})$$

$$= 11.8 \text{ m/s}$$

12



The figure shows a bucket hanging motionless from a rope. Assume that the rope has no mass. What is the net force on the bucket?

- 0.0 N
 2.0 N
 9.8 N

~~2.0 N~~ 20. N

$$F = m \cdot a = (2 \text{ kg})(9.81 \text{ m/s}^2) = 19.6 \text{ N}$$

13

Solve the following:

$$(9 \times 10^9)(2 \times 10^{-4})(8 \times 10^3) = 144 \times 10^8 = 1.44 \times 10^{10}$$

$$(5 \times 10^7)(8 \times 10^{-6})(4.2 \times 10^4) = 168 \times 10^5 = 1.7 \times 10^7$$

$$(2 \times 10^3) / (4 \times 10^{-8}) = .5 \times 10^{11} = 5 \times 10^{10}$$

$$\frac{(3.5 \times 10^{15} \text{ kg})(2.24 \times 10^4 \text{ m})}{(6.7 \text{ s})^2} = \frac{7.84 \times 10^{19} \text{ kg} \cdot \text{m}}{44.9 \text{ s}^2}$$

$$1.7 \times 10^{18} \frac{\text{kg} \cdot \text{m}}{\text{s}^2}$$

Note: displacement is the straight line distance

14

A physics student went on a vacation last summer to the Black Hills in South Dakota. They traveled 1000 km [S] from Winnipeg to the hills, saw the sights and made the 1000 km [N] return trip home a week later. Upon their arrival back home they discovered that they left their suitcase in a hotel at Sturgis while on their way home (located 750 km [S] of Winnipeg).

a) Calculate the distance and displacement experienced by the student

1000 km South
1000 km North

distance traveled = 2000 km
displacement = 0

b) Calculate the distance and displacement experienced by the suitcase.

750 km

distance traveled = 750 km
displacement = 750 km

15

If an object moves 3 m North, then 5m East, then 2m South, what is the distance traveled? **10 m**

What is its displacement? solve for hyp **5.09 m**

16

Define Vector
a quantity that has direction

Define Scalar:
a quantity without direction

17

Identify the following as a vector or a scalar (V or S)

<u>S</u> Speed	<u>S</u> Time
<u>V</u> Velocity	<u>V</u> Momentum
<u>V</u> Acceleration	<u>V</u> Weight
<u>V</u> Force	<u>S</u> Mass

18

What is the difference between speed and velocity?
Speed is scalar b/c it does not have direction
Velocity is a vector b/c it does have direction

19

What is the difference between average speed and average velocity?
Average speed does not have direction, but average velocity does have direction.

20

What is the average speed of an object that travels 65 meters in 4.3 seconds?

$$s = \frac{d}{t} = \frac{65 \text{ m}}{4.3 \text{ s}} = \boxed{15.1 \text{ m/s}}$$

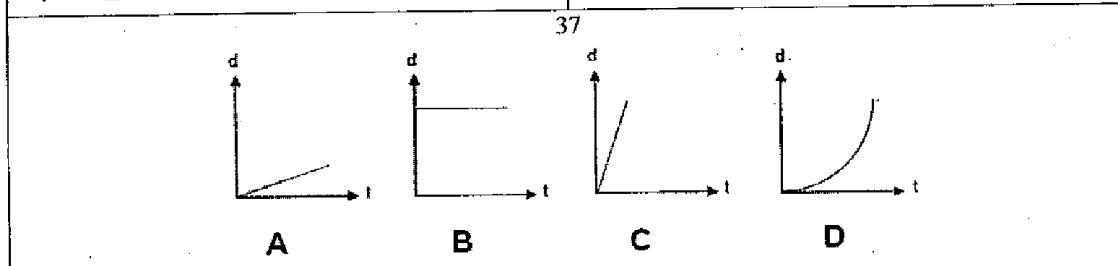
<p>21 What is the average velocity of an object that moves 67 meters, North in 4.1 s?</p> $V_{avg} = \frac{d}{t} = \frac{67m}{4.1s} = \boxed{16.3 \text{ m/s North}}$	<p>If an object goes from rest to 70 m/s in 15s uniformly, what is its average speed?</p> $V_{avg} = \frac{1}{2}(V_f + V_i) = \frac{1}{2}(70 \frac{m}{s} + 0)$ $V_{avg} = \boxed{35 \frac{m}{s}}$
<p>23 How far will the object in 22 travel in those 15 seconds?</p> $V_{avg} = \frac{d}{t}; d = V_{avg} \cdot t = (35 \frac{m}{s})(15s)$ $d = \boxed{525m}$	<p>24 In 22 what will be the object's acceleration?</p> $a = \frac{\Delta V}{\Delta t} = \frac{V_f - V_i}{t} = \frac{70 \frac{m}{s} - 0 \frac{m}{s}}{15s}$ $a = \boxed{4.66 \frac{m}{s^2}}$
<p>25 What is the average speed of an object that accelerates uniformly from 3.6 m/s to 6.7 m/s?</p> $V_{avg} = \frac{1}{2}(V_f + V_i) = \frac{1}{2}(6.7 \frac{m}{s} + 3.6 \frac{m}{s})$ $V_{avg} = \boxed{5.15 \frac{m}{s}}$	<p>26 How far will an object going 8.3 m/s travel in 16.7 s?</p> $s = \frac{d}{t} \Rightarrow d = s \cdot t = (8.3 \frac{m}{s})(16.7s)$ $d = \boxed{138.61m}$
<p>27 What is the acceleration of an object which uniformly changes its velocity from 7.6 m/s to 19.4 m/s in 3 seconds.</p> $a = \frac{\Delta V}{\Delta t} = \frac{V_f - V_i}{t} = \frac{19.4 \frac{m}{s} - 7.6 \frac{m}{s}}{3s}$ $a = \boxed{3.9 \frac{m}{s^2}}$	<p>28 If an object uniformly accelerates from rest and it takes 8.8 s to cover a distance of 82m, how fast will it be going at the end of 6.8s? $\boxed{14.3 \frac{m}{s}}$</p> <p>1) solve for V_{avg} 2) solve for V_f @ 8.8s <i>see attached</i> 3) solve for a 4) solve for V_f @ 6.8s <i>without</i></p>
<p>29 In problem 28, what is the rate of acceleration?</p> $\boxed{2.1 \frac{m}{s^2}}$	<p>30 How far will an object go in 8.7s if it undergoes a uniform acceleration of 3.9 m/s² (assume the object started from rest)? $\boxed{148m}$</p> <p><i>see attached</i></p>
<p>31 What is the final velocity of an object after a distance of 225m if it has an acceleration of 4.6 m/s² (assume the object started from rest)?</p> $\boxed{45.5 \frac{m}{s}}$ <p><i>see attached</i></p>	<p>32 What is the final velocity of an object after 8.0s if it starts from rest and accelerates at 6.3 m/s²?</p> $v_i = 0, a = 6.3 \frac{m}{s^2}, v_f = ?$ $a = \frac{\Delta V}{\Delta t}; a = \frac{V_f}{t}; V_f = a \cdot t = (6.3 \frac{m}{s^2})(8.0s)$ $V_f = \boxed{50.4 \frac{m}{s}}$

33. An object is traveling East when it begins to slow down. What is the value of its acceleration?
 _____ \ominus (+ or -)

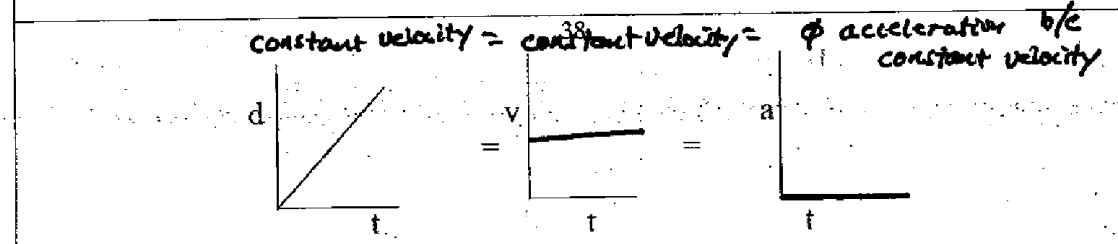
34. In a displacement time graph, the slope equals the object's velocity.

35. In a velocity-time graph, the slope equals the object's acceleration.

36. In a velocity time graph, the area beneath the curve equals the object's distance.



Which distance-time graph(s) above show(s) an object with a non-zero constant velocity? a, c
 Which distance-time graph(s) above show(s) an object undergoing uniform positive acceleration? d
 Which distance-time graph(s) above show(s) an object that is not moving? B
 Which distance-time graph(s) above show(s) an object that is increasing speed? d



In the graphs shown above, sketch the velocity-time graphs for the given displacement-time graph.


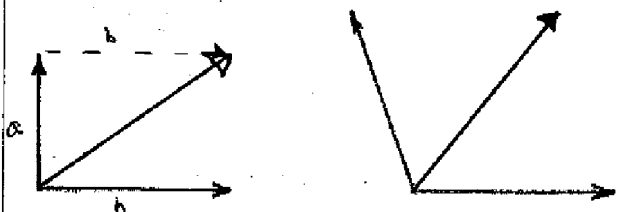
39. What's the final velocity of an object that starts at 6.9 m/s, and accelerates to 5.0 m/s² for 4.8s?
 v_i v_f a t

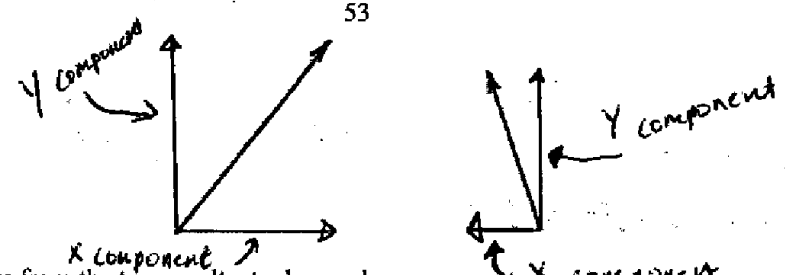

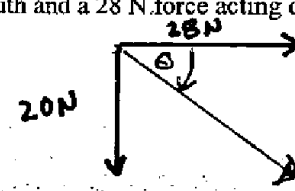
$a = \frac{\Delta v}{\Delta t}$; $\Delta v = a \cdot t$
 $v_f - v_i = a \cdot t$
 $v_f = a \cdot t + v_i$
 $v_f = (5 \text{ m/s}^2)(4.8 \text{ s}) + 6.9 \text{ m/s}$
 $v_f = \boxed{30.9 \text{ m/s}}$

40. How far will an object travel if it starts from rest and accelerates at 8.82 m/s² for 10 seconds?
 d v_i

$V_{avg} = a \cdot t \rightarrow$ have t need V_{avg}
 $V_{avg} = \frac{1}{2}(v_f + v_i) \rightarrow$ have v_i need v_f

$a = \frac{\Delta v}{\Delta t}$; $v_f = a \cdot t = (8.82 \text{ m/s}^2)(10 \text{ s}) = 88.2 \text{ m/s}$
 $V_{avg} = \frac{1}{2}(88.2 \text{ m/s} + 0) = 44.1 \text{ m/s}$
 $d = V_{avg} \cdot t = (44.1 \text{ m/s})(10 \text{ s}) = \boxed{441 \text{ m}}$

<p>41 v_f</p> <p>What will be the final velocity of an object that starts at 2.5 m/s, and accelerates to 7.3 m/s² for a distance of 82m?</p> $v_f = \sqrt{v_i^2 + 2ad}$ $v_f = \sqrt{2.5^2 + 2(7.3)(82)}$ $v_f = \boxed{39.6 \frac{m}{s}}$	<p>Vertical motion</p> <p>42</p> <p>When an object is dropped from a height of 38m, how long will it take to hit the ground?</p> $t = \sqrt{\frac{2d}{g}} = \sqrt{\frac{(2)(38m)}{9.81 m/s^2}} = \boxed{2.8s}$
<p>43 v_f</p> <p>In question 42, how fast will the object be going when it hits the ground?</p> $v_f = g \cdot t = (9.81 m/s^2)(2.8s) = \boxed{27.3 \frac{m}{s}}$	<p>44 v_f t</p> <p>How fast will an object be going after 5.4 seconds when it is dropped from rest?</p> $v_f = g \cdot t = (9.81 m/s^2)(5.4s) = \boxed{53 m/s}$
<p>45</p> <p>What is the rate of acceleration due to gravity on Earth $9.81 m/s^2$</p>	<p>46</p> <p>Is gravity a vector or a scalar?</p> <p>Vector b/c force is down \downarrow.</p>
<p>47</p> <p>If it takes a thrown object 2.7s to go as high as it will go, how long will it take it to come back down? $2.7s$ b/c what goes up will come down at the same rate</p>	<p>48</p> <p>How far will an object fall in 6.8s?</p> $d = \frac{1}{2}gt^2 = (0.5)(9.81 m/s^2)(6.8s)^2 = \boxed{227m}$
<p>49</p> <p>The unit for force is the <u>Newton</u></p> <p>One of these results in a mass of <u>1</u> kg have an acceleration of <u>1</u> m/s².</p>	<p>50</p> <p>Are forces vectors or scalars?</p> <p>Vector</p>
<p>51</p> <p>Draw a force of 5.5 N pulling due west on a object.</p> <p>5.5 N west</p> 	<p>52</p>  <p>Construct resultants for the vectors shown above. (parallelogram method)</p>

<p style="text-align: right;">53</p>  <p>Construct components from the two resultants shown above.</p>	
<p style="text-align: center;">54</p> <p>What is the greatest resultant obtainable with two concurrent forces of 6.8 N and 2.3 N?</p> <p style="text-align: center;">$6.8\text{N} + 2.3\text{N} = 9.1\text{N}$</p> <p>What is the smallest? $6.8\text{N} - 2.3\text{N} = 3.5\text{N}$</p>	<p style="text-align: center;">55</p> <p>If a force of 6.5 N acts due West on an object while another of 8.8 N acts due north, what is the magnitude of the resultant?</p>  <p style="text-align: right;">Magnitude: 10.9 N dir: 36° W of N</p> <p>What is the direction of the resultant?</p>
<p style="text-align: center;">56</p> <p>Using the parallelogram method, find the resultant (magnitude and direction) of a 20 N force acting due south and a 28 N force acting due east.</p>  <p style="text-align: right;">Magnitude: $a^2 = b^2 + c^2$ $a^2 = 20^2 + 28^2$ $a = 34.4\text{N}$</p> <p style="text-align: right;">dir: $\theta = \sin^{-1} \left[\frac{20\text{N}}{34.4} \right]$</p>	<p style="text-align: center;">57</p> <p>Just as concurrent forces can be combined into a resultant, a single force can be <u>resolved</u> into two or more <u>components</u> forces.</p>
<p style="text-align: center;">58</p> <p>Newton's First Law is also known as the.</p> <p style="text-align: center;"><u>Inertia</u></p>	

$$\theta = \sin^{-1} \left[\frac{20\text{N}}{34.4\text{N}} \right]$$

$$\theta = 35^\circ$$

dir = 35° South of East

<p>59</p> <p>An object that has no net force acting on it may be at <u>rest</u>, or may be moving at a <u>constant velocity</u>.</p> <p>If there is an unbalanced force, the object will be <u>accelerating</u>.</p>	<p>60</p> <p>What will be the acceleration resulting from a 8.7 N force acting on a 9 kg mass?</p> <p>$F = ma$; $a = \frac{F}{m} = \frac{8.7 \text{ N}}{9 \text{ kg}} = 0.97 \text{ m/s}^2$</p>
<p>61</p> <p>What force is needed to accelerate a 445 kg object at 3.3 m/s^2?</p> <p>$F = ma = (445 \text{ kg})(3.3 \text{ m/s}^2) = 1468 \text{ N}$</p>	<p>62</p> <p>$1 \text{ kg} \times 1 \text{ m/s}^2$ is one <u>1 Newton</u>.</p>
<p>63</p> <p>If you weigh 200 N and sit on a chair, with what force is the chair pushing on you?</p> <p>The chair is pushed with an equal and opposite force, 200 N up.</p>	<p>64</p> <p>What is the difference between mass and weight?</p> <p>mass - amount of matter in an object weight - object's response to gravity</p> <p>If an object travels from the Earth to the Moon, what is the difference in the object's weight?</p> <p>The difference is $.166$ or $1/6^{\text{th}}$</p>
<p>65</p> <p>Identify the following as either a vector or a scalar.</p> <p>Mass <u>scalar</u> Weight <u>vector</u> Force <u>vector</u></p>	<p>66</p> <p>If an 67 kg person weighs 300 N on a different planet, what is the gravitational acceleration of that planet?</p> <p>$w = m \cdot g$; $g = \frac{w}{m} = \frac{300 \text{ N}}{67 \text{ kg}} = 4.5 \text{ m/s}^2$</p>

weight is a force due to gravity
units are Newton


67

In which situation is the net force acting on an object equal to zero.

- ↳ forces are balanced so no change in motion*
- a. A satellite moving at constant speed around the Earth in a circular orbit.
 - b. A pitched baseball being hit by a bat
 - c. An automobile breaking to a stop.
 - d.** A bicycle moving at constant speed on a straight level road.

68

A net force of 25 Newtons is applied horizontally to a 10 kg block resting on a table. What is the magnitude of the acceleration of the block?



$F = ma; a = \frac{F}{m} = \frac{25\text{ N}}{10\text{ kg}} = 2.5\text{ m/s}^2$

69

The diagram shows a 5 kg block at rest on a horizontal frictionless table. Which diagram best represents the force exerted on the block by the table?



A



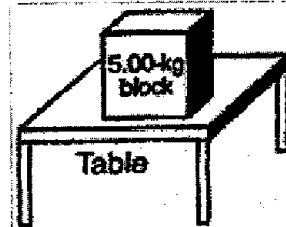
B



C

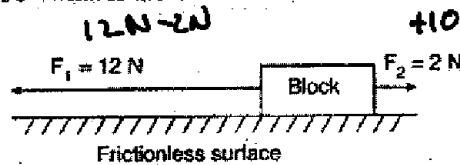


D



70

Two forces F_1 and F_2 are applied to a block on a frictionless horizontal surface as shown. If the magnitude of the block's acceleration is 2 m/s^2 , what is the mass of the block?



12 N - 2 N
+10 N total force
 $F = ma$
 $m = \frac{F}{a} = \frac{10\text{ N}}{2\text{ m/s}^2} = 5\text{ kg}$

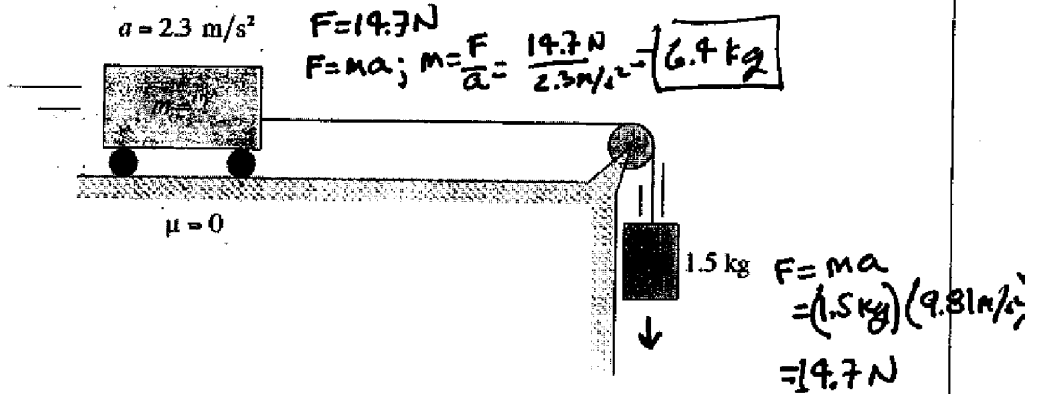
71

The data table below lists the mass and speed of four different objects. Which object has the greatest inertia?

Object	Mass (kg)	Speed (m/s)
A	4.0	6.0
B	6.0	5.0
C	8.0	3.0
D	16.0	1.5

72

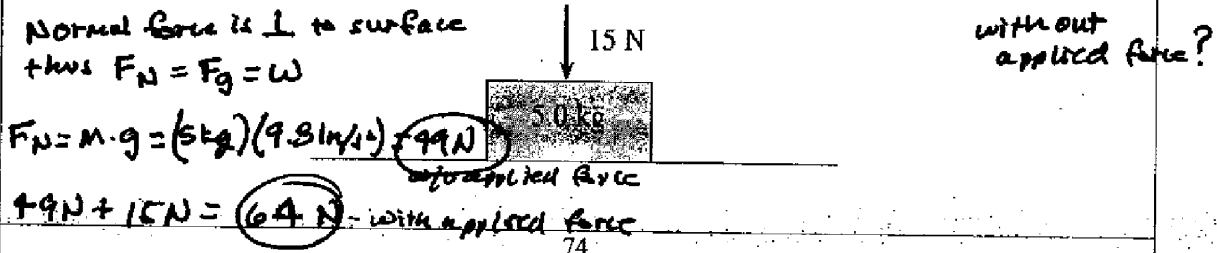
A light cord connects a moving cart to a mass over a pulley as shown. If the cart is accelerating at 2.3 m/s^2 , what is its mass?



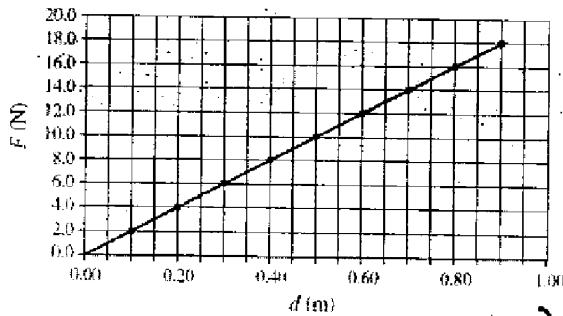
- A. 2.8 kg
- B. 3.5 kg
- C. 4.9 kg
- D. 6.4 kg

73

A 15 N force is applied to a 5.0 kg block as shown. What is the normal force on the block? *with or without applied force?*



A changing force applied to an object is described by the F vs. d graph below. What is the work done by this force as it moves the object from 0.40 to 0.60 m?



- A. 0.80 J
- B. 2.0 J
- C. 3.2 J
- D. 20 J

$W = Fd = (4 \text{ N})(.2 \text{ m}) = 0.8 \text{ J}$

75

While driving down the highway, a bug splats on your windshield. The force of the windshield on the bug is (circle one)

less than, **greater than**, equal to
the force of the bug on the windshield.

76

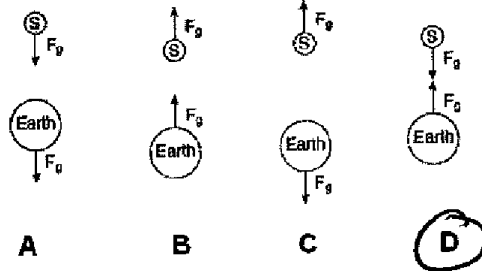
The combined mass of a race car and its driver is 600 kg. Traveling at constant speed, the car completes one circular lap around the track of radius 160 m in 36 seconds. Calculate the magnitude of the centripetal acceleration of the car.

1) solve for $v_c = \frac{d}{t} = \frac{1005 \text{ m}}{36 \text{ s}} = 27.9 \frac{\text{m}}{\text{s}}$

$$a_c = \frac{v_c^2}{r} = \frac{(27.9 \text{ m/s})^2}{160 \text{ m}} = 4.9 \frac{\text{m}}{\text{s}^2}$$

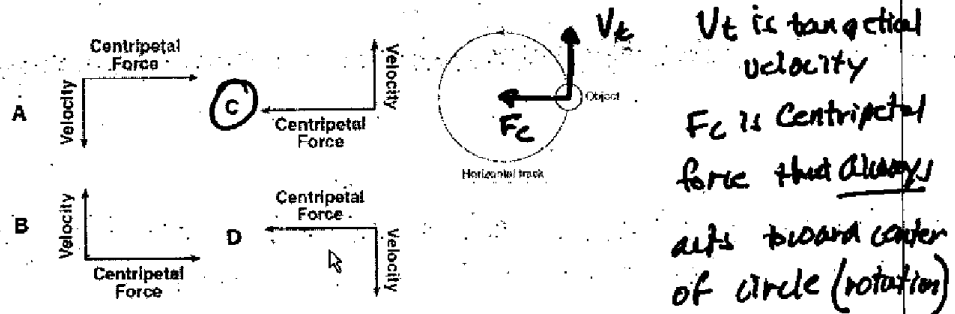
77

Which diagram best represents the gravitational forces between a satellite S and Earth?



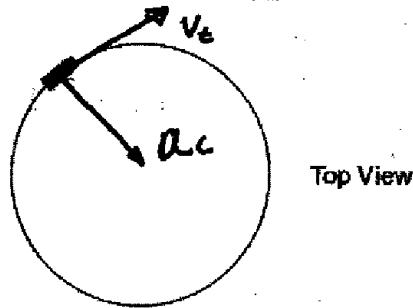
78

The diagram shows an object moving counterclockwise around a horizontal, circular track. Which diagram represents the direction of both the object's velocity and the centripetal force acting on the object when it is in the position shown?



79

An object is in clockwise uniform horizontal circular motion.



Which of the following shows the correct direction of the velocity and centripetal acceleration of the object at the point shown?

	DIRECTION OF THE VELOCITY	DIRECTION OF THE CENTRIPETAL ACCELERATION
A.		
B.		
C.		
D.		

80

A satellite is placed in an orbit at a distance R from the centre of the earth. It is then moved to a new orbit of distance $2R$ from the earth's centre. Which of the following is the correct ratio of the gravitational force in the new orbit to that of the old orbit?

- A. 1/2
- B. 1/4
- C. 2/1
- D. 4/1

$$F_c = \frac{mV_c^2}{r}$$

Note: make up numbers easy to work with to check concept eg: 1 kg mass

$$V_c = 2 \text{ m/s}$$

$$r = 1 \text{ m}$$

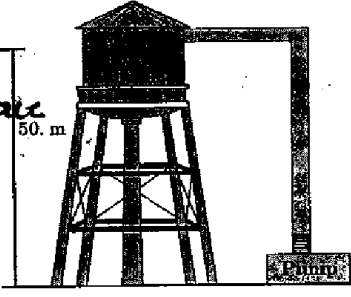
<p>81</p> <p>If an applied force of 7.4 N keeps an object moving at a constant velocity, what is the frictional force?</p> <p>$F_f = -7.4 \text{ N}$ since the object is moving at a constant velocity (no acceleration) the forces are balanced</p>	<p>82</p> <p>Write the formula for momentum</p> <p>$p = m v$</p> <p>Give the units for each variable in the formula.</p> <p>$p \rightarrow \text{kg} \cdot \frac{\text{m}}{\text{s}}$ $m \rightarrow \text{kg}$ $v \rightarrow \frac{\text{m}}{\text{s}}$</p>
<p>83</p> <p>What is the momentum of a 15.8 kg object moving at 7.0 m/s?</p> <p>$p = m \cdot v = (15.8 \text{ kg})(7.0 \text{ m/s}) = 111 \text{ kg} \cdot \frac{\text{m}}{\text{s}}$</p>	<p>84</p> <p>A 4 kg object moving at 3 m/s strikes an 8 kg object and stops (transfers all of its energy to the 8 kg object). How fast will the 8 kg object travel?</p> <p><i>conservation of p</i></p> <p>$(4 \text{ kg})(3 \text{ m/s}) + (8 \text{ kg})(0 \frac{\text{m}}{\text{s}}) = (4 \text{ kg})(0 \frac{\text{m}}{\text{s}}) + (8 \text{ kg})(v_f)$</p> <p>$12 \text{ kg} \cdot \frac{\text{m}}{\text{s}} + 0 = 0 + 8 \text{ kg} \cdot \frac{\text{m}}{\text{s}}$</p> <p>$p = m \cdot v \quad v_f = \frac{p}{m} = \frac{12 \text{ kg} \cdot \frac{\text{m}}{\text{s}}}{8 \text{ kg}} = 1.5 \frac{\text{m}}{\text{s}}$</p>
<p>85</p> <p>What is impulse? - the amount of time a force is applied to an object</p> <p>What is the symbol for impulse? Δp</p> <p>What is the unit for impulse? $\text{kg} \cdot \frac{\text{m}}{\text{s}}$</p>	<p>86</p> <p>If a force of 15 N is applied for 3 seconds, what is the impulse produced?</p> <p>$F \cdot \Delta t = p$</p> <p>$(15 \text{ N})(3 \text{ s}) = 45 \text{ kg} \cdot \frac{\text{m}}{\text{s}}$</p>
<p>Impulse problem 87</p> <p>A force of 12 N is applied for 5s to an 8 kg object's will cause what change in the object's velocity?</p> <p>$F \cdot \Delta t = p$; $F \cdot \Delta t = m \cdot v$</p> <p>$(12 \text{ N})(5 \text{ s}) = 8 \text{ kg} \cdot v$</p> <p>$v = 7.5 \text{ m/s}$</p>	<p>88</p> <p>When a rifle is fired, how does the momentum of the bullet compare to the momentum of the rifle?</p> <p>The momentums are equal and opposite.</p>
<p>conservation of momentum 89</p> <p>If a 60 kg skater moving a 3.8 m/s strikes a 100 kg skater at rest, and they cling together, what will be the velocity of the pair?</p> <p>$(60 \text{ kg})(3.8 \text{ m/s}) + (100 \text{ kg})(0 \frac{\text{m}}{\text{s}}) = (160 \text{ kg}) \cdot v_f$</p> <p>$228 \text{ kg} \cdot \frac{\text{m}}{\text{s}} + 0 = 160 \text{ kg} \cdot \frac{\text{m}}{\text{s}}$</p> <p>$p = m \cdot v$; $v = \frac{p}{m} = \frac{228 \text{ kg} \cdot \frac{\text{m}}{\text{s}}}{160 \text{ kg}} = 1.4 \frac{\text{m}}{\text{s}}$</p>	<p>90.</p> <p>If someone standing on a frictionless surface throws an 8.2 kg ball at 8.8 m/s, with what speed will that person go backwards? This depends on the mass of the person, the person will be <u>less</u> than the ball</p>

<p style="text-align: center;">91</p> <p>If a 340 kg object traveling a 66 m/s collides head-on with a 180 kg object going 112 m/s, what will be the result?</p> <p><i>Negative w/c dir</i></p> $(340 \text{ kg}) \left(\overset{\text{right}}{66 \frac{\text{m}}{\text{s}}} \right) + (180 \text{ kg}) \left(\overset{\text{left}}{-112 \frac{\text{m}}{\text{s}}} \right) = 520 \text{ kg} \cdot \text{v}$ <p><i>both objects going 4.9 m/s right</i></p>	<p style="text-align: center;">92</p> <p>What is the value of the universal gravitational constant? 6.673×10^{-11}</p> <p>What is its symbol? G</p> <p>What are its units? $\text{N} \cdot \frac{\text{m}^2}{\text{kg}^2}$</p>
<p style="text-align: center;">93</p> <p>How do changes in the distance between two objects affect the gravitational force between them?</p> <p><i>It is inversely proportional. An increase in distance results in a decrease of F_g</i></p>	<p style="text-align: center;">94</p> <p>How do changes in two objects' masses affect the gravitational force between them?</p> <p><i>It is directly proportional. An increase in mass will result in an increase in F_g</i></p>
<p style="text-align: center;">95</p> <p>If one object has a mass of 57.5 kg and a second object has a mass of 77.9 kg, and they are 30 m apart, what is the gravitational attraction between them?</p> $F_g = \frac{G \cdot m_1 \cdot m_2}{r^2}$ $F_g = \frac{(6.673 \times 10^{-11} \text{ N} \cdot \frac{\text{m}^2}{\text{kg}^2}) (57.5 \text{ kg}) (77.9 \text{ kg})}{(30 \text{ m})^2}$ $F_g = 3.3 \times 10^{-11} \text{ N}$	<p style="text-align: center;">96</p> <p>If one mass doubles, the gravitational force becomes <u>2x</u> what it was.</p> <p>If the distance is doubled, the gravitational force becomes <u>1/2</u> what it was.</p>
<p style="text-align: center;">97</p> <p>What is the definition for work? <i>The amount of force required to move an object through a distance</i></p> <p>What is the formula for work? $W = Fd$</p> <p>What is the unit for work? <i>Joule</i></p>	<p style="text-align: center;">98</p> <p>What is the definition for power? <i>The rate at which work (W) is done.</i></p> <p>What is the formula for power? $P = \frac{W}{t}$</p> <p>What is the unit for power? <i>watts</i></p>
<p style="text-align: center;">99</p> <p>By definition, 1 joule equals - <i>one Newton of force to move a one kg object through 1 meter</i></p> <p>A watt equals - <i>a 1 Joule of work done in 1 second of time.</i></p>	<p style="text-align: center;">100</p> <p>The less time it takes to do a certain amount of work, the more <u>power</u> it takes.</p>

101
 In question 80 if the work was done in 5.7 s, what power is required?
~~omit~~

102
 If a bulldozer pushes against a building with 6.5×10^{15} N of force, but the building didn't move, how much work was done? None!
 $W = F \cdot d = (6.5 \times 10^{15} \text{ N})(0 \text{ m}) = \boxed{0 \text{ J}}$

103
 A city's water tower has a capacity of 1.0×10^3 kg of water. A pump is filling the water tower to an average height of 50. m. How much work is done by the pump to fill the 1.0×10^3 -kg tower?
 Use 9.81 m/s^2 w/c work is being done against force of gravity



$W = F \cdot d$
 $F = ma$
 $= (1000 \text{ kg})(9.81 \text{ m/s}^2)$
 $= 9810 \text{ N}$
 $W = F \cdot d$
 $= (9810 \text{ N})(50 \text{ m})$
 $= 490500 \text{ J}$
 $= 4.9 \times 10^5 \text{ J}$

104
 What is the difference between kinetic and potential energy?
 KE - energy of an object in motion
 PE - energy at rest, stored energy or energy of position

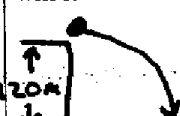
105
 Give some examples of Chemical potential energy.
 ATP, Batteries
 Give some examples of Elastic potential energy.
 springs, rubber bands

106
 What is the unit for energy? Joule
 What is the formula for gravitational potential energy? $PE_g = m \cdot g \cdot h$
 What is the formula for kinetic energy?
 $KE = \frac{1}{2} m \cdot v^2$

107
 What's the potential energy of an 32.6 kg object located 17.23m above the ground?
 $PE = mgh = (32.6 \text{ kg})(9.81 \text{ m/s}^2)(17.23 \text{ m})$
 $= \boxed{5510 \text{ J}}$

108
 What is the kinetic energy of an 8.2 kg object that is moving at 9.4 cm/s?
 $v = 9.4 \text{ cm/s} = .094 \text{ m/s}$
 $KE = \frac{1}{2} m v^2 = \frac{1}{2} (8.2 \text{ kg}) (.094 \text{ m/s})^2$
 $= \boxed{.036 \text{ J}}$

109
 State the law of conservation of energy.
 Energy can not be created or destroyed. Its form can be changed

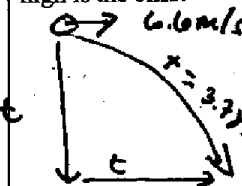
<p>110 In any system, the loss or gain of potential energy equals the loss of gain of <u>Kinetic</u> energy.</p>	<p><u>m</u> <u>h</u> 111 A 15 kg object falls 7.3m, what will be its loss of potential energy? $\text{PE} = (15 \text{ kg})(9.8 \text{ m/s}^2)(7.3 \text{ m})$ As the object drops 7.3m it will lose 1074J of <u>PE = 1074J</u> energy</p>
<p>112 In problem 121, how fast will the object be traveling at the end of those 7.3m? <u>omit</u></p>	<p>113 What is elastic potential energy? <u>stored energy in a stretched or compressed spring</u> What is the spring constant? <u>The stored energy (J-m) that has the ability to do work.</u></p>
<p>114 The weight of a bicyclist and a bicycle together is 53.0 kg. How much work has been done if the bicyclist slows the bicycle from a speed of 3.84 m/s to 1.27 m/s? (work = ΔKE) $KE = \frac{1}{2} m v^2$ $= (5)(53 \text{ kg})(3.84 \text{ m/s})^2$ $= 391 \text{ J}$ $KE = \frac{1}{2} m v^2$ $= (5)(53 \text{ kg})(1.27 \text{ m/s})^2$ $= 43 \text{ J}$ <u>change in work is = 348 J</u></p>	<p>115 A boy lifts a stack of six identical books from the floor to a 1.2-m-high shelf in 2.5 s. If lifting the books requires 50.8 W of power, what is the mass of each book? A. 0.88 kg B. 1.1 kg <u>C. 1.8 kg</u> D. 2.9 kg <u>work backwards from power to mass. see below</u></p>
<p>116 When an object is thrown horizontally off of a cliff at the same time another object is dropped from the cliff, which object will hit the ground first? <u>They will hit the ground at the same time</u></p>	<p>117 If an object is thrown horizontally from a 120m high cliff with an initial velocity of 31.3 m/s, how long will it take to reach the bottom of the cliff? $t = \sqrt{\frac{2d}{g}} = \sqrt{\frac{2(120 \text{ m})}{9.81 \text{ m/s}^2}} = 4.9 \text{ s}$ </p>
<p>118 How far from the base of the cliff will it land? $V_x = 31.3 \text{ m/s}$ $t = 4.9 \text{ s (from 117)}$ $V_{avg} = \frac{d}{t}; d = V_{avg} \cdot t = (31.3 \frac{\text{m}}{\text{s}})(4.9 \text{ s})$ <u>$d = 153.9 \text{ m}$</u></p>	

1. $P = \frac{W}{t}; W = P \cdot t = (50.8 \text{ W})(2.5 \text{ s})$
 $W = 127 \text{ J}$

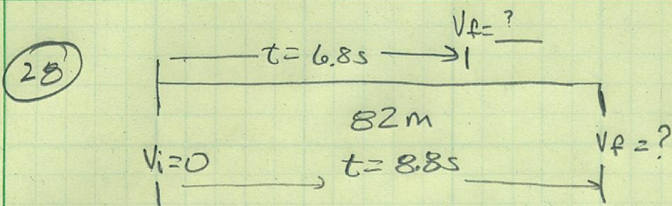
2. $W = F \cdot d; F = \frac{W}{d} = \frac{127 \text{ J}}{1.2 \text{ m}}$
 $F = 105.8 \text{ N}$

3. $F = m \cdot a; m = \frac{F}{a} = \frac{105.8 \text{ N}}{9.81 \text{ m/s}^2}$

17
 $m = 10.8 \text{ kg} / 6 = 1.8 \text{ kg}$
books

<p>118</p> <p>If an object takes 3.78 seconds to reach the bottom when thrown horizontally, at 6.6 m/s off a cliff, how high is the cliff?</p>  $d = \frac{1}{2}gt^2$ $= (5)(9.81\text{m/s}^2)(3.78\text{s})^2$ $= \boxed{70\text{M}}$	<p>120</p> <p>The force acting on objects moving in a circle is directed toward the center of the circle. This force is known as <u>centripetal force</u>.</p>
<p>121</p> <p>If the centripetal force is removed from an object in circular motion, that object will move in what direction? <i>It will then move in a straight line that is tangent to the circular motion</i></p>	<p>122</p> <p>Acceleration directed toward the center of a circle is known as <u>centripetal acceleration (a_c)</u></p> <p>Centripetal force and <u>a_c</u> keep an object moving in a circular path.</p>
<p>123</p> <p>What is the centripetal acceleration on a bicyclist going around a curve (radius = 15m) at 7.7 m/s?</p> $a_c = \frac{v^2}{r} = \frac{(7.7\text{m/s})^2}{15\text{m}} = \boxed{4.0\text{m/s}^2}$	<p>124</p> <p>What is the centripetal force on a 85 kg object moving at 5.3 m/s around another object a 8.7 m away?</p> $F_c = \frac{m \cdot v^2}{r} = \frac{85\text{kg} \cdot 5.3\text{m/s}^2}{8.7\text{m}} = \boxed{274\text{N}}$

Furry



1) Solve for $V_{avg} = \frac{d}{t} = \frac{82m}{8.8s} = 9.3m/s$

2) Solve for V_f $V_{avg} = \frac{1}{2}(V_f + V_i)$

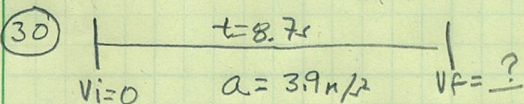
$V_f = (V_{avg}) \cdot 2 = 9.3m/s \cdot 2 = 18.6m/s$

29 3) Solve for $a = \frac{\Delta V}{\Delta t} = \frac{18.6m/s}{8.8s} = 2.1m/s^2$

4) Solve for $V_f @ 6.8s$ $a = \frac{\Delta V}{\Delta t}$ $\Delta V = a \cdot t$

$V_f = a \cdot t$ (with $V_i = 0$)

$V_f = (2.1m/s^2)(6.8s) = 14.3m/s$

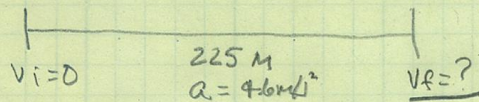


1) $V_f = a \cdot t = (3.9m/s^2)(8.7s) = 33.9m/s$

2) $V_{avg} = \frac{1}{2}(V_f + V_i) = .5(33.9m/s) = 17.0m/s$

3) $V_{avg} = \frac{d}{t}$ $d = V_{avg} \cdot t = (17m/s)(8.7s) = 148m$

31 $a = \frac{\Delta V}{\Delta t}$



$V_{avg} = \frac{1}{2}(V_f + V_i)$

$V_{avg} = \frac{d}{t}$

$a = \frac{\Delta V}{\Delta t} = \frac{V_f - V_i}{t}$ 1) $a = \frac{V_f}{t}$

2) $V_{avg} = \frac{d}{t}$

have d
need V_{avg}

3) $V_{avg} = \frac{1}{2}(V_f + V_i)$

have a
need t

31) solve for v_f

$$\begin{array}{ccc} | & \xrightarrow{d=225\text{ m}} & | \\ v_i = \phi & a = 4.6\text{ m/s}^2 & v_f = ? \end{array}$$

1) $a = \frac{\Delta v}{\Delta t}$; $a = \frac{v_f}{t}$ (b/c $v_i = \phi$) $\rightarrow v_f = at$
have a , need t

2) $v_{avg} = \frac{1}{2}(v_f + v_i)$; $v_{avg} = \frac{v_f}{2}$ (b/c $v_i = \phi$) $v_f = 2 v_{avg}$

3) $v_{avg} = \frac{d}{t}$ \rightarrow substitute $\frac{d}{t}$ into v_{avg}

$v_f = 2 \frac{d}{t}$ \rightarrow substitute $\frac{2d}{t}$ into v_f

$$\frac{2d}{t} = a \cdot t$$

$$2d = a \cdot t^2$$

$$t^2 = \frac{2d}{a}$$

$$t = \sqrt{\frac{2d}{a}} = \sqrt{\frac{2(225\text{ m})}{4.6\text{ m/s}^2}} = 9.89\text{ s}$$

now use t to solve for v_f

$$v_f = a \cdot t = (4.6\text{ m/s}^2)(9.89\text{ s}) = 45.5\text{ m/s}$$

$$(91) \quad (340 \text{ kg}) \left(66 \frac{\text{m}}{\text{s}}\right) + (180 \text{ kg}) \left(-112 \frac{\text{m}}{\text{s}}\right) = 520 \text{ kg} \cdot v_f$$

- 1) -112 m/s because that object is moving in the opposite direction
- 2) assume the objects stick together after collision

$$22440 \text{ kg} \cdot \frac{\text{m}}{\text{s}} - 20160 \text{ kg} \cdot \frac{\text{m}}{\text{s}} = 2280 \text{ kg} \cdot \frac{\text{m}}{\text{s}}$$

Solve for v_f ; $p = m \cdot v_f$ after the collision

$$2280 \text{ kg} \cdot \frac{\text{m}}{\text{s}} = 520 \text{ kg} \cdot v_f$$

$$v_f = 4.4 \text{ m/s}$$