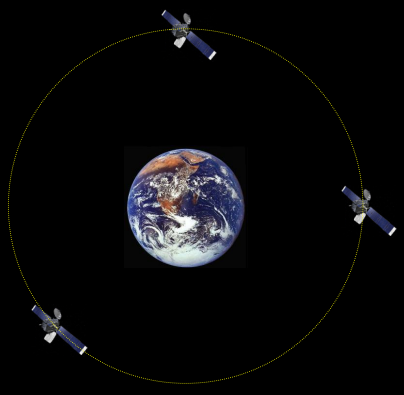
Questions of the Day

Uniform Circular Motion (UCM)

&

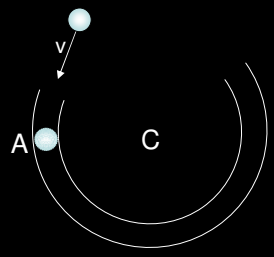
Some Semester Review “Throwbacks”

Question of the Day



- A satellite is in orbit around Earth. Draw a force diagram for the positions shown.
- *Answer: Only force is F_g, toward center of Earth*

Question of the Day

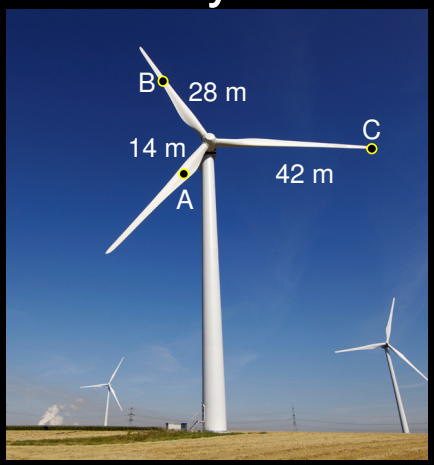


- A marble enters a frictionless groove, as pictured above. "C" is the center of the circle. At position "A", which of the following forces are acting upon the marble?
  a. downward force of gravity
  b. force exerted by the groove directed from A to C
  c. force in the direction of motion
  d. force from C to A
- *Answer: downward F_g & force by groove from A to C*

Question of the Day

- It takes 4.3 s for a wind turbine blade to complete one revolution. Complete the following table.

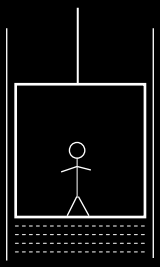
	A	B	C
Angular Velocity, ω			
Linear Velocity, v			



- *Answer: ω= 360°/4.3s = 83.7°/s at A,B,C; v_A = 88.0m/4.3s = 20.5 m/s, v_B = 176m/4.3s = 40.9 m/s, v_C = 264m/4.3s = 61.4m/s (137 mph)*

Question of the Day

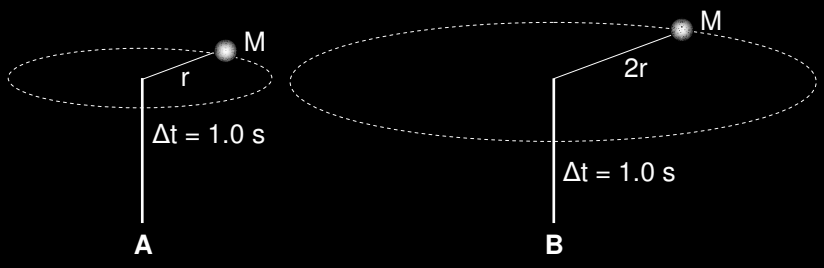
throwback



elevator being lifted up by cable at constant velocity

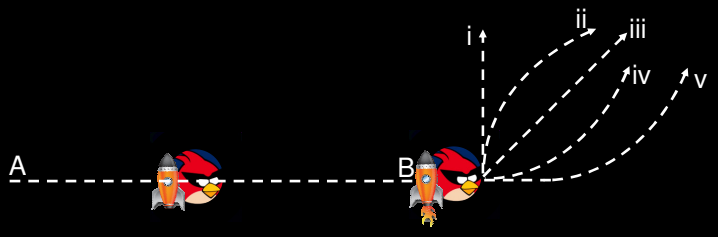
- Which of the following best describes the forces acting upon the elevator?
  a. upward force from cable > downward force of gravity
  b. upward force from cable = downward force of gravity
  c. upward force from cable < downward force of gravity
  d. none of the above
- *Answer: b, forces balance each other, $\Sigma F = 0$, $\Delta v = 0$.*

Question of the Day



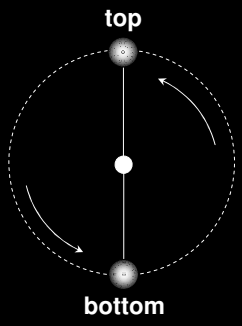
- Compare the angular velocity of A to B.
- Compare the linear velocity of A to B.
- *Answer: A & B have equal angular velocities, but B has 2x the linear velocity.*

throwback Question of the Day



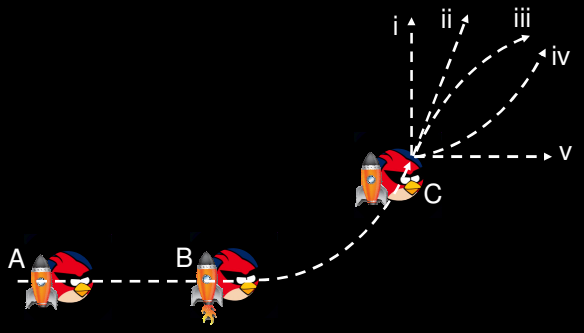
- An angry bird is drifting freely through outer space from "A" to "B". At "B", it turns on a rocket-pack that produces a constant thrust at 90° to its motion. Which is the best representation of the bird's resulting path?
- *Answer: "iv", immediate parabolic path (the rocket provides a constant unbalanced upward force)*

Question of the Day



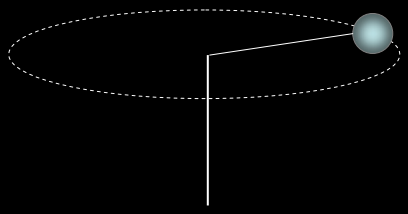
- A ball is attached to a string and is being swung in a vertical circle. Draw a force diagram for the ball when it is (a) at the top and (b) when it is at the bottom.
- *Answer: At top → F_g down, F_T down (if even present), in order for ΣF to be toward center of circle. At bottom → F_g down, F_T up, $F_T > F_g$ in order for ΣF to be toward the center of the circle*

throwback Question of the Day



- At “C”, the rocket-pack is turned off and the thrust immediately goes to zero. Which is the best representation of the bird’s resulting path?
- *Answer: “ii”, returns to constant velocity in new direction.*

Question of the Day



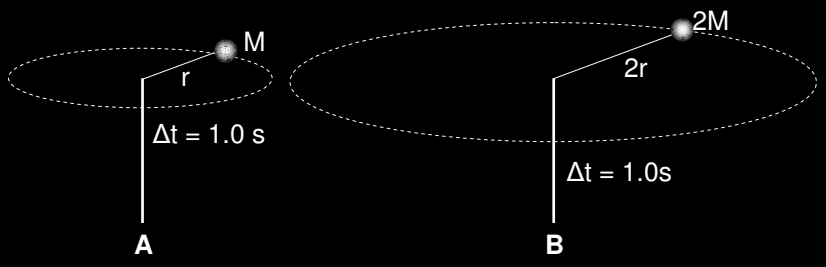
- What would happen to the centripetal force if…
  - the mass doubled?
  - the velocity doubled?
  - the radius doubled?
  - all of the above were done at the same time?
- *Answer: centripetal force would double, quadruple, half, quadruple*

throwback Question of the Day

Part 1

- A team of sled dogs exert a constant horizontal force on a heavy sled on a flat field. As a result, the sled moves across the field at a constant speed, v_i. The constant horizontal force applied by the dogs…
  a. has the same magnitude as the weight of the sled
  b. is greater than the weight of the sled
  c. has the same magnitude as the total force which resists the motion of the sled
  d. is greater than the total force which resists the motion of the sled
  e. is greater than either the weight of the sled or the total force which resists its motion
- *Answer: "c", the horizontal forces must balance for constant velocity*

Question of the Day



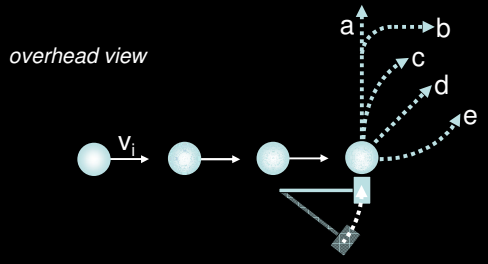
- For objects A & B, compare their:
  – Linear velocity
  – Angular velocity
  – Centripetal acceleration
  – Centripetal force
- *Answer: B has twice the linear velocity, they have equal angular velocities, B has twice the centripetal acceleration, B has four times the centripetal force*

throwback Question of the Day

Part 2

- The team of sled dogs now doubles the amount of constant horizontal force that they exert on the sled. As a result, the sled now moves…
  a. with a constant speed that is double the speed "v_i" in the previous question
  b. with a constant speed that is greater than the speed "v_i" in the previous question, but not necessarily twice as fast
  c. for a while with a speed that is constant and greater than the speed "v_i" in the previous question, then with a speed that increases thereafter
  d. for a while with an increasing speed, then with a constant speed thereafter
  e. with a continuously increasing speed
- *Answer: "e", the horizontal forces are unbalanced → acceleration, increasing speed*

throwback Question of the Day



- A ball travels along a frictionless surface with constant velocity, v_i. A hammer applies a swift hit perpendicular to v_i, as shown above.
  – Which path will the ball follow after being hit?
  – After being hit, the speed of the ball is:
    a. same as v_i before being hit
    b. v_h, the speed that results from the hit, unrelated to the previous v_i
    c. equal to the arithmetic sum of v_i and v_h
    d. smaller than either v_i or v_h
    e. greater than v_i or v_h, but less than the arithmetic sum of the two speeds
- *Answer: path "d", speed of the ball is "e"*

throwback Question of the Day

Part 3

- If the team of sled dogs suddenly let their harnesses go slack and stopped exerting a horizontal force on the sled, then the sled will…
  a. immediately come to a stop
  b. continue moving at a constant speed for a while and then slow to a stop
  c. immediately start slowing to a stop
  d. continue at a constant speed
  e. increase its speed for a while and then start slowing to a stop
- *Answer: "c", the horizontal forces are unbalanced → acceleration, decreasing speed*