Midterm1 Practice [Edit]

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Due: 1:00am on Thursday, September 27, 2012

Note: You will receive no credit for late submissions. To learn more, read your instructor's Grading Policy

Problem 2.33

Part A

A toy rocket is launched vertically from ground level (y = 0.00 m), at time t = 0.00 s. The rocket engine provides constant upward acceleration during the burn phase. At the instant of engine burnout, the rocket has risen to 50 m and acquired a velocity of 50 m/s. The rocket continues to rise in unpowered flight, reaches maximum height, and falls back to the ground with negligible air resistance. The speed of the rocket upon impact on the ground is closest to

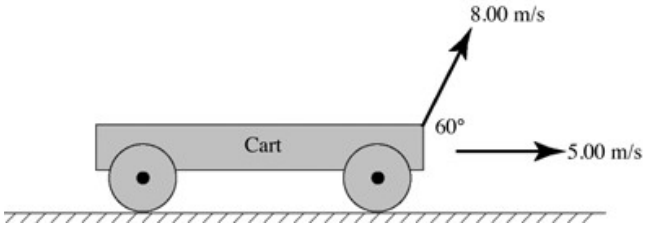
ANSWER:

- 59 m/s
- 54 m/s
- 48 m/s
- 72 m/s
- 66 m/s

Problem 3.30

Part A

A cart is moving with a constant horizontal velocity of 5.00 m/s. A small pebble is launched from the front of the cart with a velocity of 8.00 m/s at 60.0° above the horizontal as measured relative to the cart (see figure) and experiences no significant air resistance. Just as the pebble returns to the level from which it was launched, its distance from the front of the cart is closest to



ANSWER:

- 11.3 m.
- 9.19 m.
- 4.60 m.
- 5.66 m.
- 2.83 m.

Problem 3.34

Part A

An aircraft performs a maneuver called an "aileron roll." During this maneuver, the plane turns like a screw as it maintains a straight flight path, which sets the wings in circular motion. If it takes it 32 s to complete the circle and the wingspan of the plane is 11.6 m, what is the acceleration of the wing tip?

ANSWER:

- 0.38 m/s^2
- 0.22 m/s^2
- 2.6 m/s^2
- 4.5 m/s^2

Problem 3.86

Two soccer players, Mia and Alice, are running as Alice passes the ball to Mia. Mia is running due north with a speed of 5.90$\mathrm{m/s}$. The velocity of the ball relative to Mia is 5.20$\mathrm{m/s}$ in a direction 30.0 $^\circ$ east of south.

Part A

What is the magnitude of the velocity of the ball relative to the ground?

Express your answer to three significant figures and include the appropriate units.

ANSWER:

v =

Part B

What is the direction of the velocity of the ball relative to the ground?

Express your answer to three significant figures and include the appropriate units.

ANSWER:

θ = north of east

Exercise 3.25

The earth has a radius of 6380 km and turns around once on its axis in 24 h.

Part A

What is the radial acceleration of an object at the earth's equator? Give your answer in $\mathrm{m/s^2}$.

ANSWER:

a_{rad} = $\mathrm{m/s^2}$

Part B

What is the radial acceleration of an object at the earth's equator? Give your answer as a fraction of g.

ANSWER:

a_{rad} = g

Part C

If a_{rad} at the equator is greater than g , objects would fly off the earth's surface and into space. What would the period of the earth's rotation have to be for this to occur?

ANSWER:

T = s

Problem 2.97

A student is running at her top speed of 5.5$\mathrm{m/s}$ to catch a bus, which is stopped at the bus stop. When the student is still a distance 41.3m from the bus, it starts to pull away, moving with a constant acceleration of 0.166$\mathrm{m/s^2}$.

Part A

For how much time does the student have to run at 5.5$\mathrm{m/s}$ before she overtakes the bus?

ANSWER:

t = s

Part B

For what distance does the student have to run at 5.5$\mathrm{m/s}$ before she overtakes the bus?

ANSWER:

d = m

Part C

When she reaches the bus, how fast is the bus traveling?

ANSWER:

v = $\mathrm{m/s}$

Part D

If the student's top speed is 2.00$\mathrm{m/s}$, will she catch the bus?

ANSWER:

- yes
- no

Part E

What is the *minimum* speed the student must have to just catch up with the bus?

ANSWER:

v = m/s

Part F

For what time does she have to run in that case?

ANSWER:

t = s

Part G

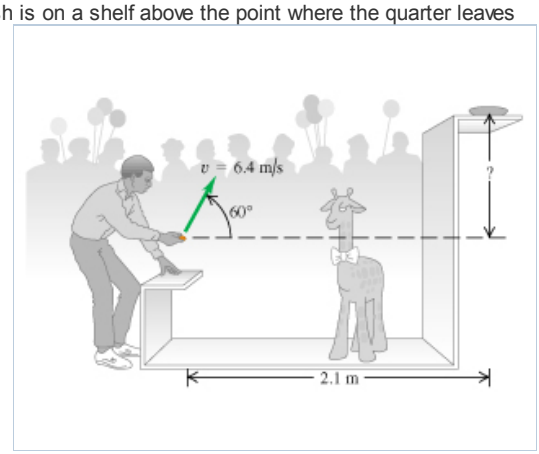
For what distance does she have to run in that case?

ANSWER:

d = m

Exercise 3.19

In a carnival booth, you win a stuffed giraffe if you toss a quarter into a small dish. The dish is on a shelf above the point where the quarter leaves your hand and is a horizontal distance of 2.1 m from this point (the figure). If you toss the coin with a velocity of 6.4 m/s at an angle of 60 ° above the horizontal, the coin lands in the dish. You can ignore air resistance.



Part A

What is the height of the shelf above the point where the quarter leaves your hand?

Express your answer using two significant figures.

ANSWER:

H = m

Part B

What is the vertical component of the velocity of the quarter just before it lands in the dish?

Express your answer using two significant figures.

ANSWER:

v_y = $\mathrm{m/s}$

Exercise 5.22

A 2850-kg test rocket is launched vertically from the launch pad. Its fuel (of negligible mass) provides a thrust force so that its vertical velocity as a function of time is given by $v(t) = At + Bt^2$, where A and B are constants and time is measured from the instant the fuel is ignited. At the instant of ignition, the rocket has an upward acceleration of 2.00$\mathrm{m/s^2}$ and 1.00s later an upward velocity of 1.68$\mathrm{m/s}$.

Part A

Determine A.

ANSWER:

A = $\mathrm{m/s^2}$

Part B

Determine B.

ANSWER:

B = $\mathrm{m/s^3}$

Part C

At 4.50s after fuel ignition, what is the acceleration of the rocket?

ANSWER:

a = $\mathrm{m/s^2}$

Part D

What thrust force does the burning fuel exert on it, assume no air resistance? Express the thrust in newtons.

ANSWER:

T = N

Part E

What thrust force does the burning fuel exert on it, assume no air resistance? Express the thrust as a multiple of the rocket's weight.

ANSWER:

T = w

Part F

What was the initial thrust due to the fuel?

ANSWER:

T_i = N

Exercise 4.8

You walk into an elevator, step onto a scale, and push the "up" button. You also recall that your normal weight is w = 625N .

Part A

Make a free-body diagram of your body if the elevator has an acceleration of magnitude a = 2.46$\mathrm{m/s^2}$.

Draw the force vectors with their tails at the dot. The orientation of your vectors will be graded. The exact lengths of your vectors will not be graded but the relative length of one to the other will be graded.

ANSWER:

Part B

What does the scale read with the conditions given in part (A)?

ANSWER:

F = N

Part C

If you start holding a 3.90kg package by a light vertical string, make a free-body diagram of the package.

Draw the force vectors with their tails at the dot. The orientation of your vectors will be graded. The exact lengths of your vectors will not be graded but the relative length of one to the other will be graded.

ANSWER:

Part D

What will be the tension in the string in part (C) once the elevator begins accelerating?

ANSWER:

T = N