Physics I
Exam 1 Review

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Outline

Must Knows!!

Constants:
$$g = 9.81 m/s^2$$
Volumes:
$$V_{Sphere} = \frac{4}{3}\pi r^3$$
$$V_{Cylinder} = \pi r^2 h$$
Surface Area:
$$A_{Sphere} = 4\pi r^2$$

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Multiple Choice

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Chapter 2: MOTION ALONG A STRAIGHT LINE

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Question 1

Two automobiles are 150 kilometers apart and traveling toward each other. One automobile is moving at 60 km/h and the other is moving at 40 km/h. In how many hours will they meet?

A 2.5

B 2.0

C 1.75

D 1.5

E 1.25

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
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A 2.5

B 2.0

C 1.75

D 1.5

E 1.25

Answer: D

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Question 2

Each of four particles move along an x axis. Their coordinates (in meters) as functions of time (in seconds) are given by:

Particle 1: $x(t) = 3.5 - 2.7t^3$
Particle 2: $x(t) = 3.5 + 2.7t^3$
Particle 3: $x(t) = 3.5 + 2.7t^2$
Particle 4: $x(t) = 3.5 - 3.4t - 2.7t^2$

Which of these particles have constant acceleration?

A All four

B Only 1 and 2

C only 2 and 3

D only 3 and 4

E None of them

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
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Which of these particles have constant acceleration?

A All four

B Only 1 and 2

C only 2 and 3

D only 3 and 4

E None of them

Answer: D

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Question 3

Of the following situations, which one is impossible?

A A body having velocity east and acceleration east

B A body having velocity east and acceleration west

C A body having zero velocity and non-zero acceleration

D A body having constant acceleration and variable velocity

E A body having constant velocity and variable acceleration

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
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B A body having velocity east and acceleration west

C A body having zero velocity and non-zero acceleration

D A body having constant acceleration and variable velocity

E A body having constant velocity and variable acceleration

Answer: E

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Question 4

An object is shot vertically upward. While it is rising:

A its velocity and acceleration are both upward

B its velocity is upward and its acceleration is downward

C its velocity and acceleration are both downward

D its velocity is downward and its acceleration is upward

E its velocity and acceleration are both decreasing

Must knows!!
Multiple Choice
Problems

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C its velocity and acceleration are both downward

D its velocity is downward and its acceleration is upward

E its velocity and acceleration are both decreasing

Answer: B

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
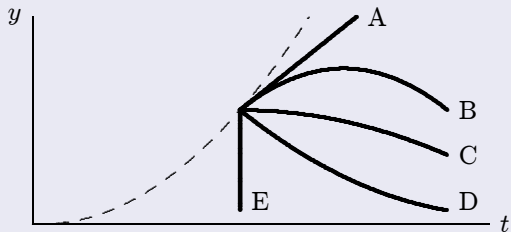Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Question 5

As a rocket is accelerating vertically upward at 9.8 m/s/s near Earths surface, it releases a projectile. Immediately after release the acceleration (in m/s/s) of the projectile is:

A 9.8 down

B 0

C 9.8 up

D 19.6 up

E None of the above

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Question 5

As a rocket is accelerating vertically upward at 9.8 m/s/s near Earths surface, it releases a projectile. Immediately after release the acceleration (in m/s/s) of the projectile is:

A 9.8 down

B 0

C 9.8 up

D 19.6 up

E None of the above

Answer: A

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
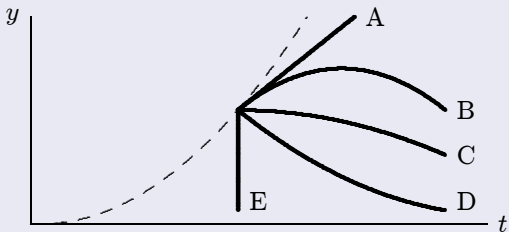Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Question 6

An elevator is moving upward with constant acceleration. The dashed curve shows the position, y, of the ceiling of the elevator as a function of the time, t. At the instant indicated by the dot, a bolt breaks loose and drops from the ceiling. Which curve best represents the position of the bolt as a function of time?

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Question 6

An elevator is moving upward with constant acceleration. The dashed curve shows the position, y, of the ceiling of the elevator as a function of the time, t. At the instant indicated by the dot, a bolt breaks loose and drops from the ceiling. Which curve best represents the position of the bolt as a function of time?

Answer: B

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
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Chapter 3: VECTORS

Must knows!!

Multiple Choice

Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE

Chapter 3: VECTORS

Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Question 1

A vector has a magnitude of 12. When its tail is at the origin it lies between the positive x axis and the negative y axis and makes an angle of $30°$ with the x axis. Its y component is:

A $6/\sqrt{3}$

B $-6\sqrt{3}$

C 6

D -6

E 12

Must knows!!
Multiple Choice
Problems

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C 6

D -6

E 12

Answer: D

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Question 2

The value of $\hat{i} \cdot \left(\hat{j} \times \hat{k} \right)$?

A zero

B +1

C -1

D 3

E $\sqrt{3}$

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
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The value of $\hat{i} \cdot \left(\hat{j} \times \hat{k} \right)$?

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D 3

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Answer: B

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
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Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Question 1

Two bodies are falling with negligible air resistance, side by side, above a horizontal plane. If one of the bodies is given an additional horizontal acceleration during its descent, it:

A strikes the plane at the same time as the other body

B strikes the plane earlier than the other body

C has the vertical component of its velocity altered

D has the vertical component of its acceleration altered

E follows a straight line path along the resultant acceleration vector

Must knows!!
Multiple Choice
Problems

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D has the vertical component of its acceleration altered

E follows a straight line path along the resultant acceleration vector

Answer: A

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Question 2

A stone thrown from the top of a tall building follows a path that is:

A circular

B made of two straight line segments

C hyperbolic

D parabolic

E a straight line

Must knows!!
Multiple Choice
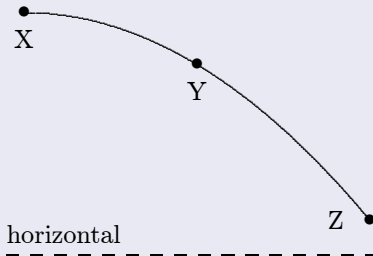Problems
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A circular

B made of two straight line segments

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E a straight line

Answer: D

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
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Question 3

A stone is thrown horizontally and follows the path *XYZ* shown. The direction of the acceleration of the stone at point *Y* is:

A ↓

B →

C ↘

D ↙

E ↗

Must knows!!
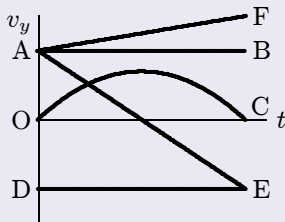**Multiple Choice**
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
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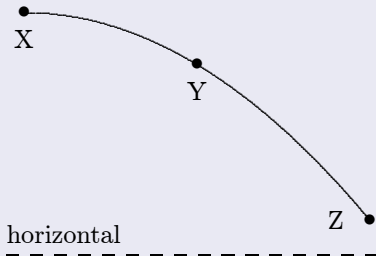
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A stone is thrown horizontally and follows the path *XYZ* shown. The direction of the acceleration of the stone at point *Y* is:

A ↓

B →

C ↘

D ↙

E ↗

Answer: A

Must knows!!
Multiple Choice
Problems

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Question 4

Which of the curves on the graph below best represents the vertical component v_y of the velocity versus the time t for a pro jectile red at an angle of $45°$ above the horizontal?
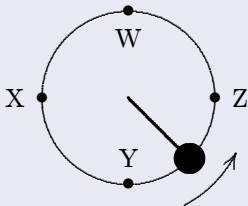

A *OC*

B *DE*

C *AB*

D *AE*

E *AF*

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
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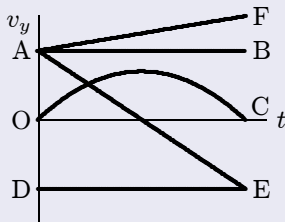
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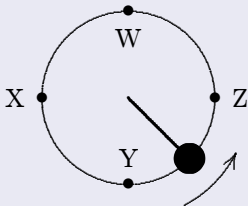A *OC*

B *DE*

C *AB*

D *AE*

E *AF*

Answer: D

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
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Question 5

An object, tied to a string, moves in a circle at constant speed on a horizontal surface as shown. The direction of the displacement of this object, as it travels from W to X is:

A $\leftarrow$

B $\downarrow$

C $\uparrow$

D $\nearrow$

E $\searrow$

Must knows!!
Multiple Choice
Problems

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An object, tied to a string, moves in a circle at constant speed on a horizontal surface as shown. The direction of the displacement of this object, as it travels from W to X is:

A $\leftarrow$

B $\downarrow$

C $\uparrow$

D $\nearrow$

E $\searrow$

Answer: E

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
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Question 6

An airplane is ying north at 500km/h. It makes a gradual $180°$ turn at constant speed, changing its direction of travel from north through east to south. The process takes 40s. The average acceleration of the plane for this turn (in km/h·s) is:

A 12.5km/h·s, north

B 12.5km/h·s, east

C 12.5km/h·s, south

D 25km/h·s, north

E 25km/h·s, south

Must knows!!
Multiple Choice
Problems

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E 25km/h·s, south

Answer: E

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
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Question 7

A particle moves at constant speed in a circular path. The instantaneous velocity and instantaneous acceleration vectors are:

A both tangent to the circular path

B both perpendicular to the circular path

C perpendicular to each other

D opposite to each other

E none of the above

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
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A particle moves at constant speed in a circular path. The instantaneous velocity and instantaneous acceleration vectors are:

A both tangent to the circular path

B both perpendicular to the circular path

C perpendicular to each other

D opposite to each other

E none of the above

Answer: C

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
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Question 8

A stone is tied to a string and whirled at constant speed in a horizontal circle. The speed is then doubled without changing the length of the string. Afterward the magnitude of the acceleration of the stone is:

A the same

B twice as great

C four times as great

D half as great

E one-fourth as great

Must knows!!
Multiple Choice
Problems

Chapter 2: MOTION ALONG A STRAIGHT LINE
Chapter 3: VECTORS
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Question 8

A stone is tied to a string and whirled at constant speed in a horizontal circle. The speed is then doubled without changing the length of the string. Afterward the magnitude of the acceleration of the stone is:

A the same

B twice as great

C four times as great

D half as great

E one-fourth as great

Answer: C

Problems

Problem 1

A car (A) speeds through town at a constant 20m/s without noticing a police car (B) parked by the roadside. The police officer begins pursuit at the instant the car passes her, accelerating at a constant 2.0m/s/s. *Use the reference frame provided*.
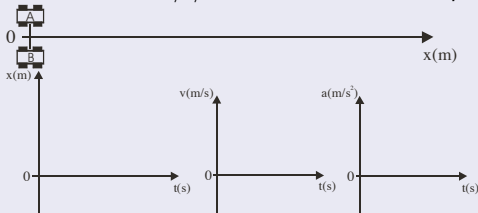
A How long does it take the officer to reach a speed of 30m/s and how far behind the speeder is she at this time?

B At the instant described is part a), the speeder immediately slows down at a constant rate of $\frac{4}{3}$m/s/s. At what rate must the officer slow down so that both vehicles stop at exactly the same location and time?

C How far down the road are the vehicles when the "catch" is made?

D Sketch the *position*, *velocity*, and *acceleration vs. time* graphs for each car on the same plots. Be sure to label your graphs by including relevant times and values for each stage of motion.

E BONUS How long does it take for the vehicles to be 19m apart?

Problem 2

A chemistry TA named Brodie is instructed to release a helium balloon (B) from rest at ground level at the same instant Dr. Jim launches a flaming arrow (A) from a horizontal distance of 300m and height of 20m above the ground at a speed of 60m/s and an initial angle of $60°$ to the horizontal, as shown. Use appropriate vector notation and the reference frame provided.
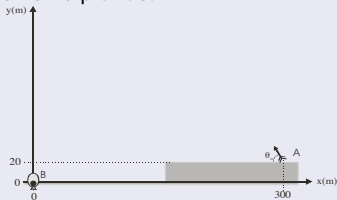
A Find the arrows distance from the origin and speed when it reaches maximum height.

B At what time does the arrow intercept the balloon and at what constant rate is the balloon accelerating?

C Find the average velocity of the arrow from launch to interception of the balloon.

D BONUS: Unbeknown to the TA, a raw chicken egg is hidden inside the balloon. Assume the flaming arrow explodes the balloon but does not interrupt the motion of the egg (Dr. Jim is THAT GOOD!). How long does it take for the egg to strike the TA? Assume collision between egg and TA occurs at ground level.