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1. (1 point)

Student Name: Arfaz Hossain
Student ID: V00984826

An asteroid of mass $m_a = 3.96 \times 10^{12}$kg is initially at rest a distance $|\vec{r}| = 1.06 \times 10^7$m away from the center of the a planet. The planet has a mass of $m = 6.11 \times 10^{24}$kg and a radius of $R = 6.11 \times 10^6$m.

(The input below will accept answers with no more than 1

The asteroid falls toward the planet. What is the speed of the asteroid when it hits the planet?

_____ $\times 10^3 \frac{\text{m}}{\text{s}}$

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Correct Answers:

- 7.517

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2. (1 point)

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A block of mass $m_1 = 4.99$kg initially travels with velocity $\vec{v}_{1i} = 28.1 \frac{\text{m}}{\text{s}} \hat{i}$.
A second block of mass $m_2 = 4.66$kg initially travels with velocity $\vec{v}_{2i} = -9.6 \frac{\text{m}}{\text{s}} \hat{i}$.
There is a spring attached to one side of m_2 which is compressed when the two blocks collide.
All motion happens on a frictionless plane, and all motion is in the x-direction.

(The input below will accept answers with no more than 1

What is the potential energy of the compressed spring the instant the blocks are closest together?

_____ J

After the collision, what are the velocities of the two blocks?

$\vec{v}_{1f}$ = _____ $\frac{\text{m}}{\text{s}} \hat{i}$
$\vec{v}_{2f}$ = _____ $\frac{\text{m}}{\text{s}} \hat{i}$

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Correct Answers:

- 1712.426
- -8.311
- 29.389

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3. (1 point)

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A star of mass $M = 2.10 \times 10^{30}$kg is the origin of a coordinate system.
A comet of mass $m = 5.83 \times 10^{12}$kg is initially at location $\vec{r} = 2.08 \times 10^{15}\text{m}\hat{i} + 4.53 \times 10^{11}\text{m}\hat{j}$. The comet is travelling with velocity $\vec{v} = 3.54 \times 10^3 \frac{\text{m}}{\text{s}} \hat{i}$.

(The input below will accept answers with no more than 1

Using conservation of energy and of angular momentum, what is the comet's distance from the star at the instant it's closest, and what is the comet's speed? (Hint: Consider the direction of the velocity relative to the position when the comet is at its closest point.)

$|\vec{r}|$ = _____ $\times 10^8$m
$|\vec{v}|$ = _____ $\times 10^5 \frac{\text{m}}{\text{s}}$

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Correct Answers:

- 91.760
- 1.748

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4. (1 point)

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A block of mass $m_1 = 5.9$kg and charge $q_1 = 1.55 \times 10^{-3}$C is held at rest at the origin.
A block of mass $m_2 = 9.69$kg and charge $q_2 = 2.93 \times 10^{-3}$C is held at rest at $\vec{r} = 3.65\text{m}\hat{i}$.
The two blocks are released from rest. The electric force that one exerts on the other is the only contributor to the net force on either.

(The input below will accept answers with no more than 1

What are the velocities of m_1 and m_2 when they are far away from each other?

$\vec{v}_1$ = _____ $\frac{\text{m}}{\text{s}} \hat{i}$
$\vec{v}_2$ = _____ $\frac{\text{m}}{\text{s}} \hat{i}$

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Correct Answers:

- -48.574
- 29.575

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5. (1 point)

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A rocket of mass $m_r = 6.68 \times 10^6$kg is launched from the surface of a planet.
The planet has a mass of $m = 6.29 \times 10^{24}$kg and a radius of $R = 6.06 \times 10^6$m.

(The input below will accept answers with no more than 1

What must its initial speed be so that it travels at a speed of $v = 2.71 \times 10^3 \frac{\text{m}}{\text{s}}$ when it is a distance $d = 1.67 \times 10^7$m from the center of the planet?

_____ $\times 10^3 \frac{\text{m}}{\text{s}}$

UVic Problem ID: 57261611324924130
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Correct Answers:

- 9.776