Ch3 HW1 (1360586)

Current Score: 0/25 **Due:** Fri Sep 17 2010 09:00 AM EDT

Question	1	2	3	4	5	6	7	8	9	Total
Points	0/1	0/2	0/5	0/2	0/1	0/4	0/4	0/4	0/2	0/25

Description

Gravitational force; fundamental interactions

Instructions

Reading: Sec. 3.1-3.4

Question 7 leads you through the several steps necessary to calculate the gravitational force as a vector. Question 8 asks you to do a similar calculation on your own; carry out the same steps as in question 7.

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1. 0/1 points MI3 3.1.X.026. [1250541]

Match the process with the fundamental interaction responsible for this process.

Process	Answer
The Earth pulls on the Moon	– The gravitational interaction
Protons and neutrons attract each other in a nucleus	– The strong interaction
A neutron outside a nucleus decays into a proton, electron, and antineutrino	– The weak interaction
Protons in a nucleus repel each other	– The electromagnetic interaction

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2. 0/2 points MI3 3.2.X.031. [1250513]

The mass of the Sun is 2×10^{30} kg, and the mass of Mercury is 3.3×10^{23} kg. The distance from the Sun to Mercury is 4.8×10^{10} m.

(a) Calculate the magnitude of the gravitational force exerted by the Sun on Mercury.

1.92e+22 N

(b) Calculate the magnitude of the gravitational force exerted by Mercury on the Sun.

1.92e+22 N

3. 0/5 points mi3 3.3.x.039.nva [1250467]

(a) Calculate the magnitude of the gravitational force exerted by Mercury on a 60 kg human standing on the surface of Mercury. (The mass of Mercury is 3.3×10^{23} kg and its radius is 2.4×10^{6} m.)

[ ] 230 N

(b) Calculate the magnitude of the gravitational force exerted by the human on Mercury.

[ ] 230 N

(c) For comparison, calculate the approximate magnitude of the gravitational force of this human on a similar human who is standing 3.5 meters away.

[ ] 1.97e-08 N

(d) What approximations or simplifying assumptions must you make in these calculations? (Note: Some of these choices are false because they are wrong physics!)

- [ ] Ignore the effects of the Sun, which alters the gravitational force that one object exerts on another.
- [ ] Treat the humans as though they were points or uniform-density spheres.
- [ ] Use the same gravitational constant in (a) and (b) despite its dependence on the size of the masses.
- [ ] Treat Mercury as though it were a uniform-density sphere.

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4. 0/2 points MI3 3.2.X.027. [1259431]

At a particular instant the magnitude of the gravitational force exerted by a planet on one of its moons is 3×10^{24} N.

(a) If the mass of the moon were six times as large, what would the magnitude of the force be?

$|\vec{F}|$ = [ ] 1.80e+25 N

(b) If instead the distance between the moon and the planet were six times as large (no change in mass), what would the magnitude of the force be?

$|\vec{F}|$ = [ ] 8.33e+22 N

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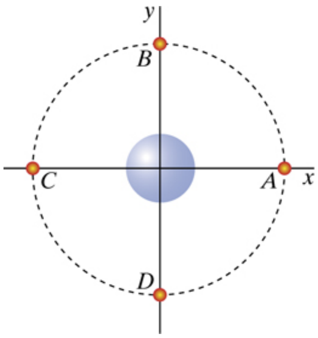
5. 0/1 points MI3 3.2.X.029. [1259435]

A planet exerts a gravitational force of magnitude 5e22 N on a star. If the planet were 5 times closer to the star (that is, if the distance between the star and the planet were 1/5 what is is now), what would be the magnitude of the force on the star due to the planet?

$|\vec{F}|$ = [ ] 1.25e+24 N

6. 0/4 points MI3 3.2.X.030. [1259420]

{A moon orbits a planet in the *xy* plane, as shown in the figure. You want to calculate the force on the moon by the planet at each location labeled by a letter (*A*,*B*,*C*,*D*). At each of these locations, what are **(a)** the unit vector $\hat{r}$, and **(b)** the unit vector $\hat{F}$ in the direction of the force?



At *A*:

$\hat{r}$ = ⟨ [ ] 1 , [ ] 0 , 0 ⟩

$\hat{F}$ = ⟨ [ ] -1 , [ ] 0 , 0 ⟩

At *B*:

$\hat{r}$ = ⟨ [ ] 0 , [ ] 1 , 0 ⟩

$\hat{F}$ = ⟨ [ ] 0 , [ ] -1 , 0 ⟩

At *C*:

$\hat{r}$ = ⟨ [ ] -1 , [ ] 0 , 0 ⟩

$\hat{F}$ = ⟨ [ ] 1 , [ ] 0 , 0 ⟩

At *D*:

$\hat{r}$ = ⟨ [ ] 0 , [ ] -1 , 0 ⟩

$\hat{F}$ = ⟨ [ ] 0 , [ ] 1 , 0 ⟩

7. 0/4 points MI3 3.2.X.008. [1250522]

A planet of mass 9×10^{24} kg is at location < 5×10^{11}, -2×10^{11}, 0 > m. A star of mass 6×10^{30} kg is at location < -4×10^{11}, 5×10^{11}, 0 > m. It will be useful to draw a diagram of the situation, including the relevant vectors.

What is the relative position vector pointing from the planet to the star?

$\vec{r}$ = < [ ] -9.00e+11 , [ ] 7.00e+11 , [ ] 0 > m

What is the distance between the planet and the star?

$|\vec{r}|$ = [ ] 1.14e+12 m

What is the unit vector $\hat{r}$ in the direction of $\vec{r}$?

$\hat{r}$ = < [ ] -0.789 , [ ] 0.614 , [ ] 0 >

What is the magnitude of the force exerted on the planet by the star?

$|\vec{F}_{\text{on planet}}|$ = [ ] 2.78e+21 N

What is the magnitude of the force exerted on the star by the planet?

$|\vec{F}_{\text{on star}}|$ = [ ] 2.78e+21 N

What is the force (vector) exerted on the planet by the star?

$\vec{F}_{\text{on planet}}$ = < [ ] -2.20e+21 , [ ] 1.71e+21 , [ ] 0 > N

What is the force (vector) exerted on the star by the planet?

$\vec{F}_{\text{on star}}$ = < [ ] 2.20e+21 , [ ] -1.71e+21 , [ ] 0 > N

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8. 0/4 points MI3 3.2.X.034. [1259436]

A planet of mass 6 × 10^{24} kg is at location ‹ −4 × 10^{11}, 7 × 10^{11}, 0 › m. A star of mass 8 × 10^{30} kg is at location ‹ 4 × 10^{11}, −4 × 10^{11}, 0 › m. What is the force exerted on the planet by the star? (It will probably be helpful to draw a diagram, including the relevant vectors.)

$\vec{F}_{\text{on planet}}$ = ⟨ [ ] 1.02e+21 , [ ] -1.41e+21 , 0 ⟩ N

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9. 0/2 points mi3 3.3.x.037.alt01.nva [1259438]

If the mass of a planet is 2.00 × 10^{24} kg, and its radius is 4.80 × 10^{6} m, what is the magnitude of the gravitational field, g, on the planet's surface?

g = [ ] 5.82 N/kg

An object of mass 7 kg rests on the surface of this planet. What is the magnitude of the gravitational force on the object?

$|\vec{F}_{grav}|$ = [ ] 40.7 N

Assignment Details