**P09 – Gravitational Field Simulation-based Practical**

**(Pre-lecture Activity)**

**http://iwant2study.org/ospsg/index.php/interactive-resources/physics/02-newtonian-mechanics/08-gravity**

*Please use Chrome to run all applets,*

Simulation 1 – Geostationary Satellites (*What’s that? Can eat or not?*)

|  |
| --- |
| C:\Users\s7412027z\Documents\get-frame.png  *You may zoom in to view better or click on any point, drag up and down to change perspective.*  https://tinyurl.com/y7udothb  teacher’s copy   1. Click  and observe the motion of a ***geostationary*** satellite near Singapore.   Note the ***period*** of the orbit*.*   1. Click on  after every run to reset the simulation before selecting another option.      1. Use the drop down menu to run two other geostationary orbits.   After observing all three ***geostationary*** orbits, I can safely conclude the  ***period*** of ***geostationary*** orbits is ……………………   1. Click on  to reset the simulation. Use the drop down menu to run other ***non***-geostationary orbits. Remember to reset after every run.   After observing different orbits including polar orbits, identify three other characteristic of geostationary satellites.  1.  2.  3.   1. Suggest possible applications for geostationary satellites. (*Why are we studying them?*) |

Simulation 2 – If Superman Throws a Ball Fast Enough…?!

https://tinyurl.com/y735eygl

|  |
| --- |
| *Graphs of KE (kinetic energy), PE (gravitational potential energy) and TE (total energy) are plotted against separation from the surface of the Earth.*   1. Use the drop down menu to select the ***initial horizontal*** speed of a ball projected from the top of a tall mountain. 2. Select **v=2000** and click  to run the simulation. |
| 1. Click on  to reset the simulation. Use the drop down menu to select **v=4000** and click  to run the simulation.   State and Explain the main difference between the paths of the two projectile motions.   1. Click on  to reset the simulation. Use the drop down menu to select **v=6000** and click  to run the simulation.   How would you explain what is happening here?   1. What is one question you have after running this simulation? 2. Click on  to reset the simulation. Use the drop down menu to select **v=8000** and click  to run the simulation.   What do you think is happening? |

欢迎来到引力场！你将被深深吸引！☺ Welcome to Gravitational Field! You will be deeply attracted!

Simulation 3 – Newton’s Law of Gravitation

*Weight is the force acting on a mass due to a gravitational field.*

*What is a gravitational field? How do two masses interact? Do they need to be in physical contact to do so?*

https://tinyurl.com/y9k69twq

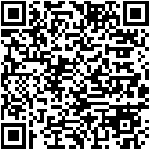
|  |  |
| --- | --- |
| 1. Click QR-Code dieser Seite to run the simulation with the **default** setting M1 = M2 = 100 kg and  r = 4.00 m.   Note down your observations. | |
| 1. Click on  to reset the simulation.   Use the drop down menu to set  M1 = 10 kg.    *You can drag the masses further apart if you wish.*   1. Click  and record your observations. | 1. Think about the difference between the two observations in **1** and **3**. Thus, explain the motion and final positions of the two masses for the second setting. 2. Draw the gravitational forces on two masses below. |

Simulation 4.1 – Gravitational Field Strength near and far

https://tinyurl.com/ybfa4aju

https://tinyurl.com/ycdljka4

|  |  |
| --- | --- |
| 1. Use the drop down menu to look at four different gravitational fields ranging from very\_outer\_space to very\_near\_Earth\_surface. | 1. Copy and Draw the gravitational field of the Earth when viewed from very outer space.   earth iconEarth |
| 1. Copy and draw the gravitational field of the Earth when viewed from very near the Earth’s surface.   Earth’s surface |
| 1. Distinguish between the two extreme cases:   very far from and very near to the Earth. | |



Simulation 4.2 – Gravitational Field Strength relationship and graph

|  |  |
| --- | --- |
| 1. Drag the mass **slowly** around to see how gravitational field strength varies   with separation from the Earth. | |
| 1. Draw, on the axes below, the graph of gravitational field strength ***g*** against separation from centre of the Earth ***r***.   ***g***  ***r*** | 1. Deduce how ***g*** is numerically related to ***r***.   Show your calculations. |

Simulation 5– Binary Stars? *Huh?*

https://tinyurl.com/yd4ehhp9

*Google for some background on binary stars.*

|  |  |  |
| --- | --- | --- |
|  | | 1. Use the drop-down menu and select **M1=M2=1,circular\_orbit**. 2. Click  and observe the motion of both masses, noting the magnitudes of the forces, F1 and F2, on each mass.   Record your observations. |
| 1. Click on  to reset the simulation.   Use the drop-down menu and now select from the menu **M1=1,M2=0.1,circular\_orbit**.   1. Click  and observe the motion, noting the orbits of the binary stars.   Record your observations.   1. Newton’s first law of motion states that an object at rest will remain at rest and an object in motion will remain in motion at ***constant velocity in a straight line*** ***in the absence of an external resultant force***.   Hence, for an object to move in circular motion, there must be a  What would you say cause the stars to move in a such a manner? | | |
| C:\Users\s7412027z\Documents\get-frame.png | Complete this lesson with an online summary of   * **3 concepts** you feel you have understood, * **2 questions** you still have, and * **1 feedback** on the practical.   https://tinyurl.com/y9d7np8e | |

**URLs for students who prefer to use laptops:**

Simulation 1 – Geostationary Satellites

https://tinyurl.com/y7udothb

Simulation 2 – If Superman Throws a Ball Fast Enough…?!

https://tinyurl.com/y735eygl

Simulation 3 – Newton’s Law of Gravitation

https://tinyurl.com/y9k69twq

Simulation 4.1 – Gravitational Field Strength near and far

https://tinyurl.com/ybfa4aju

Simulation 4.2 – Gravitational Field Strength relationship and graph

https://tinyurl.com/ycdljka4

Simulation 5– Binary Stars?

https://tinyurl.com/yd4ehhp9

Conclusion

https://tinyurl.com/y9d7np8e