

# Gravity as a Contact Force Essay

## AP Physics 1/Gravitation/grades 11-12

**Materials:** Students will need access to the class Moodle and to their Google Drive.

The teacher will need a computer with internet access hooked up to a projector and a nerf ball (or other spherical object that can be dropped without damage).

**Instructions for the teacher:** This is a two paragraph essay that should be assigned during the unit on gravitation, after students have studied kinematics, projectiles, forces, energy and momentum. The essay is sort of “science meets creative writing” in that students ponder how an athletic activity would be different under the imaginary condition of gravity as a contact force.

- After covering Newton’s Universal Law of Gravitation and the physics of orbits, I assign this essay.
- To introduce the essay, I take a nerf ball and ask the students to describe the motion of the ball as it drops from rest and as it is thrown up in the air and falls back down. We discuss the motion in terms of velocity, acceleration, forces, and energy. We then discuss the field nature of gravity.
- I then display the [essay instructions](#) on the board using a projector. Students can access the instructions through the class Moodle but a link could be provided on the teacher/class website instead. The instructions can also be found on page 2 of this document.
- I go over the instructions, and answer any questions.
- Students then have two weeks to write their essay as a Google doc and submit their work to the Moodle. Students are expected to complete this assignment outside of class.
- The essays are then graded according to the [rubric](#) which students can also view through a link on the Moodle. The rubric is also given on page 3 of this document. I am using the rubric function on the Moodle for actual grading purposes, but a rubric could be constructed through Google Forms.

**Standards:** This assignment addresses the following standards for AP Physics 1 as written by the College Board. The standards can be found in the [AP Physics 1 course description](#).

- ☐ Big idea 2: Fields existing in space can be used to explain interactions.
- ☐ Big idea 3: The interactions of an object with other objects can be described by forces.
- ☐ Big idea 4: Interactions between systems can result in changes in those systems.
- ☐ Big idea 5: Changes that occur as a result of interactions are constrained by conservation laws.
- ☐ Science practice 6: The student can work with scientific explanations and theories.
- ☐ Science practice 7: The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains.



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## AP Physics 1 Gravity as a Contact Force Essay

Choose your favorite athletic activity such as tennis or basketball or swimming or ping pong or hang-gliding or bungee jumping, etc. Ponder what it would be like to participate in your favorite athletic activity **IF gravity were a contact force instead of a field force**. This means that gravity would only act on an object IF that object were in direct contact with the Earth\*. Let Newton's Laws of Motion guide you!

\*Technically, if gravity really were a contact force, the Earth would never have formed and even if it had, it wouldn't orbit the sun. But for the sake of this assignment, let's ignore these small issues.

Your essay will consist of two paragraphs as described below. Be sure to describe the physics involved in your activity--use words like velocity, force, kinetic energy, etc.

### **Paragraph 1:**

How would the activity be different if gravity were a contact force? For example, imagine dribbling a basketball. How and why would this change if gravity were a contact force? Be sure to describe ALL major aspects of your activity. There is more to basketball than just dribbling.

### **Paragraph 2:**

How could the rules or equipment be adjusted so that your activity would be played if gravity were a contact force? For example, imagine shooting a basketball on a world where gravity is a contact force. Would it go through the basket? If not, how could the game be changed? Again, be sure to address ALL aspects of your activity.

**Type up your essay as a Google doc. Then before you submit your assignment, make sure to proofread your paragraphs for both spelling and grammar.** Yes, spelling and grammar DO count towards the grade. Also, a paragraph less than 5 sentences will not receive full credit.

This assignment is worth 25 points. Please take a moment to view the [grading rubric](#) before you submit your essay to make sure that you have covered everything.

Once you have completed your essay, return to the Moodle and submit your essay by 11 pm on the due date. The Moodle will accept assignments after 11pm, but the assignments will be LATE. To submit your work, choose File→Download as→Microsoft Word (or PDF). Then upload your document to the Moodle AND provide a link to the document in the text window.



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# AP Physics 1

## Gravity as a Contact Force Grading Rubric

<b>Paragraph #1 Length</b>	Nothing submitted  0points	Less than 5 sentences  1points	5 or more sentences, but many are just filler  2points	5 or more sentences that are thoughtful and purposeful  3points
<b>Paragraph #1: Physics of sport</b>	Nothing submitted  0points	Vague or incorrect application of physics concepts  2points	Valid attempt to describe physics of sport but with some minor flaws.  3points	Complete and correct description of the physics involved in the activity when gravity is a contact force.  4points
<b>Paragraph #1: Address all aspects of sport</b>	Nothing submitted  0points	One aspect addressed.  1points	Two or more aspects addressed, but still an incomplete description of sport.  2points	ALL aspects of sport are covered.  3points
<b>Paragraph #2 Length</b>	Nothing submitted  0points	Less than 5 sentences  1points	5 or more sentences, but many are just filler  2points	5 or more sentences that are thoughtful and purposeful  3points



<b>Paragraph #2: Modifications to sport</b>	Nothing submitted  0points	Vague or incorrect modifications. Poor physics.  2points	Valid attempt to modify sport but with some minor flaws or omissions. 3points	Complete and correct modifications that show good physics. 4points
<b>Paragraph #2: Address all aspects of sport</b>	Nothing submitted  0points	One aspect addressed.  1points	Two or more aspects addressed, but still an incomplete description of sport.  2points	ALL aspects of sport are covered.  3points
<b>Grammar/Punctuation</b>	Nothing submitted  0points	Unnecessary number of punctuation, formatting and spelling errors which make essay difficult to read. Spell check would have fixed many of these mistakes.  1points	Some punctuation, formatting, and spelling errors. Spell check may not catch the difference between, say, "form" and "from" but proofreading would have helped.  3points	No or few punctuation, formatting, and spelling errors. Writing is clear and conforms to standard grammar and spelling conventions. Words are used correctly.  5points

