**Course: Utah Game Development Fundamentals 1 | Module: Create Interactive Game Worlds**

# Lesson 3.3: Game Physics

https://codehs.com/course/20515/lesson/3.3

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| **Description** | In this lesson, students dive into rigidbodies and colliders, learning more about the Unity's built-in physics engine. |
| **Objective** | Students will be able to:<br><br>• Define the purpose of rigidbody components.<br>• Define the purpose of collider components.<br>• Apply rigidbody and collider components to their GameObjects.<br>• Use a script to trigger collision events. |
| **Activities** | 3.3.1 Video: Rigidbodies and Colliders<br>3.3.2 Notes: Download Unity Project<br>3.3.3 Connection: Dive Deeper: Rigidbodies<br>3.3.4 Notes: Tutorial: Apply Rigidbodies<br>3.3.5 Free Response: Apply Rigidbodies<br>3.3.6 Connection: Dive Deeper: Colliders<br>3.3.7 Notes: Tutorial: Explore Colliders<br>3.3.8 Free Response: Explore Colliders<br>3.3.9 Notes: Tutorial: Collision Events<br>3.3.10 Free Response: Collision Events<br>3.3.11 Notes: Tutorial: Projectiles<br>3.3.12 Free Response: Projectiles<br>3.3.13 Notes: Tutorial: Character Controllers<br>3.3.14 Free Response: Character Controllers |
| **Prior Knowledge** | • Adding GameObjects and configuring their properties. |
| **Planning Notes** | • Review Unity rigidybody and collider documentation<br>• In this lesson, students download a Unity project file that's used throughout the activities.<br>• This lesson includes two external videos that provide more details about the lesson's topics. Make sure you can play them on your school's network.<br>• This lesson may take students a couple class periods to complete. |
| **Standards Addressed** | |

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| **Teaching and Learning Strategies** | **Lesson Opener:**<br><br>• Have students brainstorm and write down answers to the beginning of class discussion questions listed below. Students can work individually or in groups/pairs. Have them share their responses. [5-10 mins]<br><br>**Activities:**<br><br>• Watch *Rigidbodies and Colliders* video. [5 mins]<br>• Complete the *Download Tutorials* activity and have students open the new project in Unity. [5 mins]<br>  ○ Ensure students are able to see the Tutorials window in Unity. If the Tutorials are hidden, instruct students to select Tutorials > Show Tutorials in the Unity menu bar.<br>  ○ Ensure students know how to access and navigate Unity documents as a resource.<br>  ○ Clarify the overall procedures for submitting Unity projects and submitting assignments with CodeHS as needed.<br>• Watch *Dive Deeper: Rigidbodies* video. [6 mins]<br>• Complete *Apply Rigidbodies* Unity tutorial and free-response questions. [10-15 mins]<br>• Watch *Dive Deeper: Colliders* video. [4 mins]<br>• Complete *Explore Colliders* Unity tutorial and free-response questions. [10 mins]<br>• Complete *Collision Events* Unity tutorial and free-response questions. [15 mins]<br>• Complete *Projectiles* Unity tutorial and free-response questions. [15-20 mins]<br>• Complete *Character Controllers* Unity tutorial and free-response questions. [15-20 mins]<br><br>**Lesson Closer:**<br><br>• Have students reflect and discuss their responses to the end of class discussion questions. [5-10 mins] |
| **Discussion Questions** | **Beginning of Lesson:**<br><br>• When two objects collide or an object falls from the sky in real life, what do we take for granted? Or in other words, if we were to try to re-create these scenarios in Unity, what may or may not happen?<br>  ○ *The two colliding objects will touch each other and actually collide (not pass through each other) and the object in the sky falls due to gravity. We can't assume that objects in Unity act the same way as they do in real life.*<br>• Brainstorm types of forces or interactions that occur in real-life and that we'd want to have in our games to make them realistic.<br>  ○ *Answers will vary, but could include forces like gravity, contact, and friction, or interactions like accelerating down a hill or slowing down due to drag.* |

- What do you think a "physics engine" is in game development, and why are they important? Research online for more information.
  - *A physics engine simulates physics in the game development environment. This prevents developers from having to program every single physics interaction, like gravity, and instead allows them add physics components and change their properties.*

**End of Lesson:**

- What is the difference between rigidbodies, colliders, and character controllers in Unity? What roles do they play in your scene?
  - *A rigidbody allows the object to be affected by simulated gravity and other forces. A collider is an invisible shape surrounding the object that handles its collisions with other objects. A character controller is a special kind of collider that allows characters to act in specific ways; additionally a rigidybody is not needed.*
- As you worked with the physics components in your scene, what seemed realistic, and what did not? How could you adjust the parts that did not seem realistic to make them more believable?
  - *Answers will vary. One sample: at first, the ball didn't fall. A rigidbody was applied so that gravity could pull it down. After colliding with the plane, the ball had no bounce, which didn't seem realistic. To fix this, a special material was added to create a bouncing effect.*

| Resources/Handouts | |
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## Vocabulary

| Term | Definition |
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| Modification: Advanced | Modification: Special Education | Modification: English Language Learners |
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- Encourage students to assist others who may be have difficulty with Unity tutorials.
- Have students create their own GameObjects (with rigidbodies and colliders) in the tutorial scenes.
- Have student read the Unity documentation about its physics components and present on findings.

- Pair students - one reads the directions and guides the other student through Unity tasks.
- Some students may benefit from writing down their responses to the open-response item in the lesson prior to typing it into the CodeHS editor.

- Some students may benefit from writing down their responses to the open-response item in the lesson prior to typing it into the CodeHS editor.
- Create a vocabulary list of lesson terms.
- Provide an English dictionary or translation tool for unknown terms.
- Pair students - one reads the directions and guides the other student through Unity tasks.