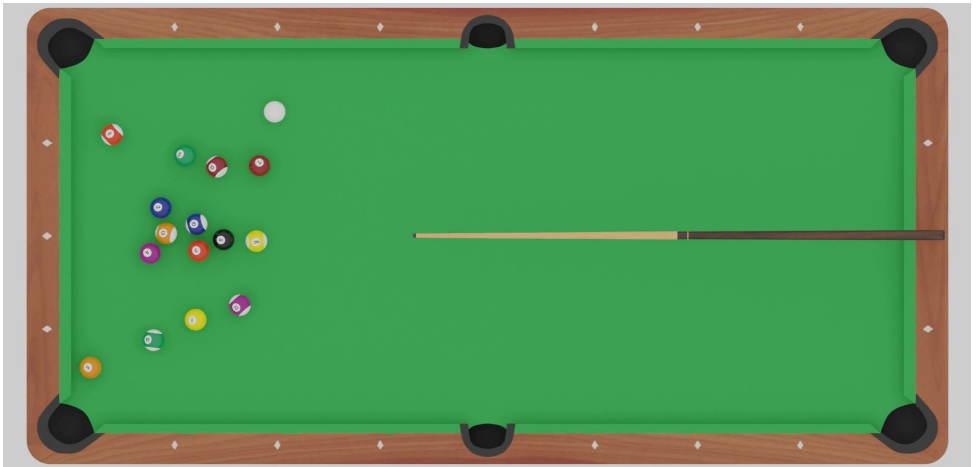


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To create an animation in Blender like the one I am currently showing on the screen, where an object is animated using keyframes and interacts with Rigid Body objects, it is necessary to **set the manually animated object as a Rigid Body Passive** with the **Animated** option selected.



Let's go step by step through the operations needed to create this animation.

All objects are parented to the billiard table, but this is not suitable for the physics simulation. Therefore, first, select all objects except the billiard table, and **clear their parent relationships** by pressing **ALT P** and choosing the **Clear Parent and Keep Transformation** option from the menu that appears on the screen.

Create a new **Collection** in which we will place all the **billiard balls**.

This allows us to quickly select them all with a right-click and Select Objects.

This will be useful when we need to modify certain parameters of the Rigid Body for all billiard balls.

Let's provide a **Rigid Body Passive component to the billiard table**, then set the **collision shape to Mesh**, allowing the balls to fall into the pockets.

The **billiard balls** will be **Active** physical objects, so select them all, open the toolbox, and type **Rigid Body Add Active** to provide this component to all billiard balls.

With my initial scene settings, the billiard balls are too light.

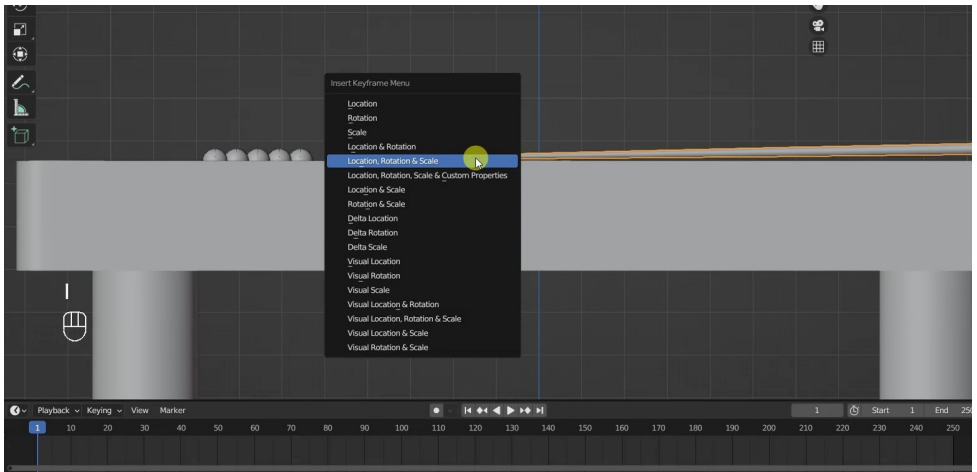
To change the mass of all billiard balls at once, first, **select them all**, then press the **ALT** key and, while holding it down, click on the **Mass** field in the **Rigid Body** tab.

Now, **release the ALT key** and enter an appropriate **value**, such as 0.16 kg. This weight will then be assigned to all billiard balls.

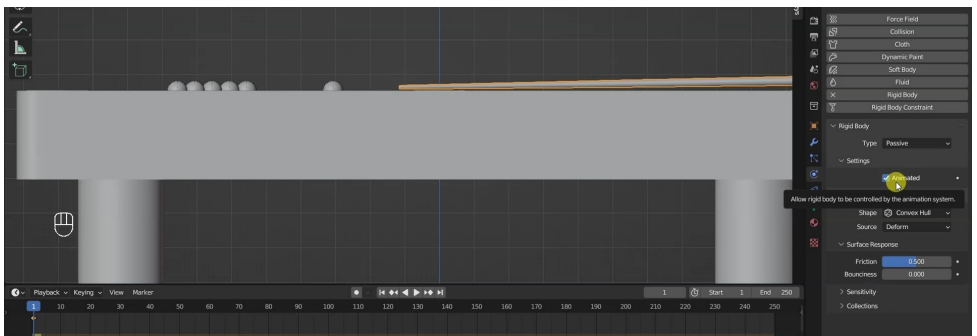
**Remember this ALT key trick** if you need to modify options for multiple objects. In this scenario, this operation might come in handy to change other parameters common to all billiard balls, such as Damping, Bounciness, and other physical parameters found in the Surface Response and Dynamics sections of the Rigid Body tab.

Use this trick again to **change the Collision Shape** of all billiard balls to **Sphere**.

Now we can **position the cue stick** at the **first frame** of the animation and insert an **animation keyframe** for the initial position.

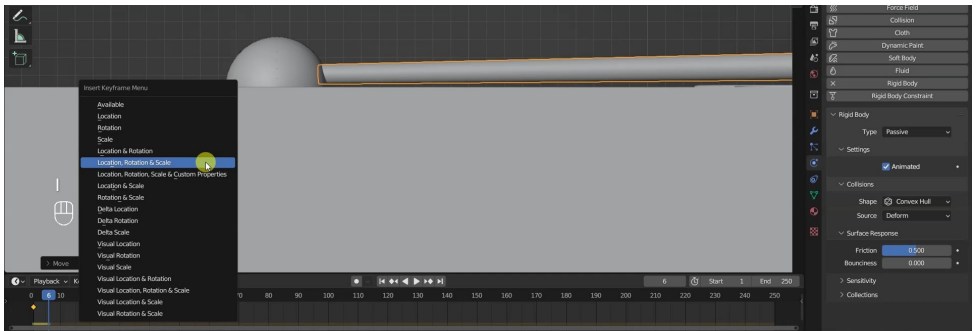


The **cue stick** should have a **Rigid Body** component of the **Passive** type, and most importantly, it should have the **Animated** option selected, as mentioned at the beginning of this tutorial.



Let's also switch to the **Local Axis** display, noting that we can move the cue stick forward or backward by displacing it along its local **X-axis**.

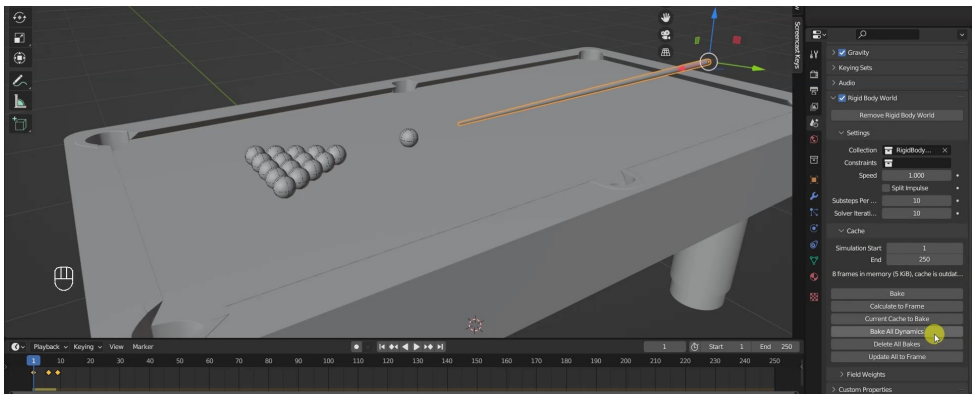
**Move to the sixth frame** of the animation, adjust the **cue stick** to strike the **white ball**, and record this animation **keyframe**.



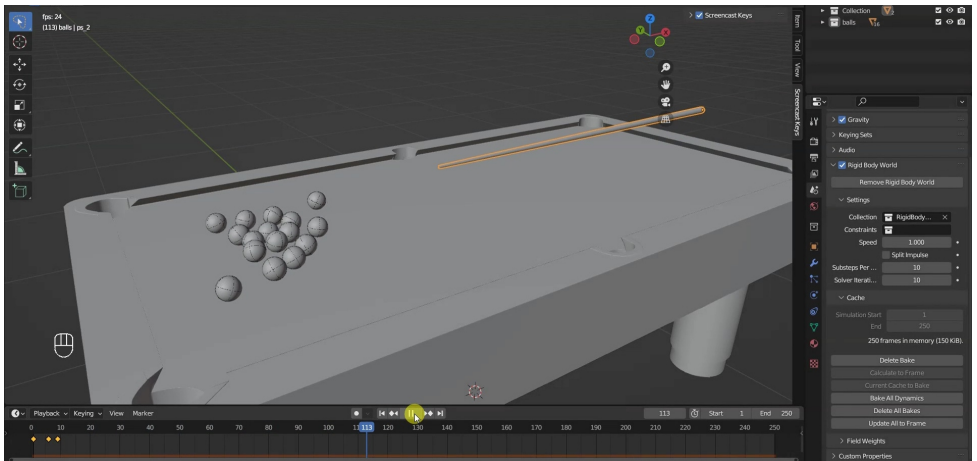
Advance another 3 frames to move the cue stick away from the table and record its new position with another animation keyframe.

Before initiating the Bake for the physics simulation, **save the scene as a new file on disk.**

Return to the **first frame** of the Timeline, open the **Scene** tab in the Properties Editor, and in the **Rigid Body World Cache** section, click on **Bake All Dynamics**.



Once the **Rigid Body simulation Bake** is complete, review the resulting animation in the 3D Viewport.



If the motion of the billiard balls appears too slow, too fast, or excessively powerful, **you can adjust various parameters**, such as the initial movement speed of the cue stick or other physical parameters like the **Friction** value of the table. I advise against lowering the Friction value of the balls too much, as they may slide on the table rather than roll!

After each modification, **clear all Bakes in the Cache section** of Rigid Body World, **return to the first frame** of the Timeline, **save the file**, and redo the physics simulation **Bake**.

The default value for the **Bounciness** parameter is 0.

**Set it to 1 for the table**, and **increase** it slightly (without exaggerating) for the billiard **balls** to avoid clustering at the bottom without rebounds.

Remember that you can change the value of a parameter for all objects in a multiple selection by simply pressing the **ALT** key when clicking on the parameter, then releasing the **ALT** key and entering the value.

Another aspect to keep in mind is **the impact speed of the cue stick** on the white ball because it is proportional to the **applied force**. There are two ways to make the cue stick movement faster.

The first method is to bring the impact keyframe closer to the first frame of the animation. You can do this by selecting **the diamonds representing keyframes** in the **Timeline** and moving them forward or backward with the **G** key.

The second method involves starting the cue stick from a more backward position, placing it further back along its X-axis in the first keyframe of the animation. In this case, you will need to re-record the keyframe.

Both methods can be used together, experimenting until you find the combination that produces the result you are most satisfied with. A good result is achieved through a balanced combination of initial distance, impact speed, and settings for Friction and Bounciness.

When conducting experiments, **remember to return to the first frame, clear the Bake, save the file, and perform a new Bake** of the Rigid Body simulation.

Well, that's all for this tutorial! I hope it has been helpful! See you soon!