WhiteHat Jr
Live Online Coding for Kids

INSTRUCTIONS:

_____

Goal of the Project:

In Class 27, you learned how to create constraints and tie together two bodies.

In this project, you will apply what you have learned in the class to achieve the following goals.

Main Goal	● Create multiple bobs, a roof and chain to add a bob with roof.
Additional Goal 1	● Add gravity code between bobs.

Story:

The Newton's Cradle is a toy which demonstrates transfer of momentum when two objects or a group of objects collide.

See a video of a Newton's Cradle in Action.
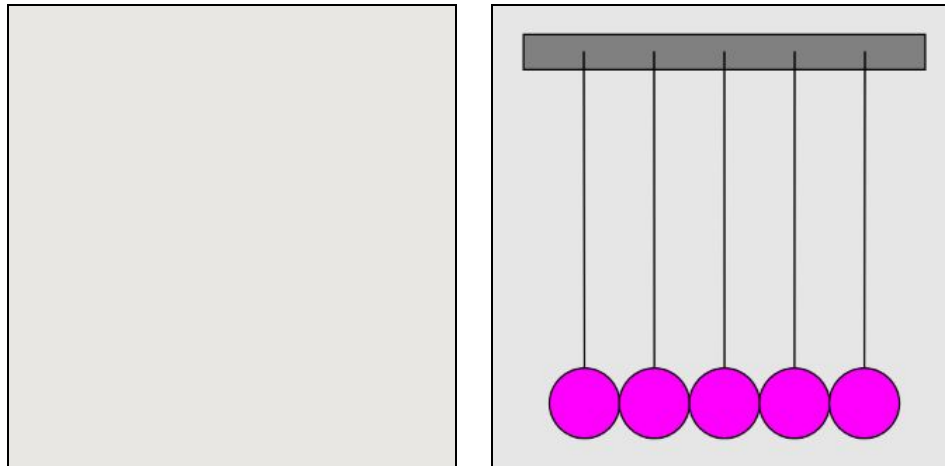
***This is just for your reference. We expect you to apply your own creativity in the project.**

Getting Started:

1. Use the blank template on github, available for download here.
2. **Unzip** this folder.
3. Rename the unzipped folder as **Project 27.**

4. **Import** this folder **into VS Code**.
5. Start editing your code in **sketch.js**.

Specific Tasks to Achieve the Main Goal:

1. A pendulum is made of a rope and a bob. The bob is the weight attached at the end of the pendulum.
2. Make a bob class:
   - You can reuse the **paper class** created on **Project C25** for this project.
   - Copy the whole class, add it to the current project and **rename** it to **bob**.
   - Make sure you also include this class in **index.html**.
3. Make a **roof class**.
   - The roof is nothing but the ground placed at a height.
   - We have created a **ground class** in **Project C24**, which can be reused and included in this project.
   - Make sure you also include this **roof** class in index.html.
4. Reuse the **Chain class** created during your class and rename it to **rope**.
   - Make sure you also include this **rope** class in index.html.
5. Create five bob objects **bobObject1**, **bobObject2**, **bobObject3**, **bobObject4**, and **bobObject5**.
   - These are arranged horizontally as shown in the image below.
   - Keep these objects some distance away from the roof. 200 pixels would be a good starting value to try.
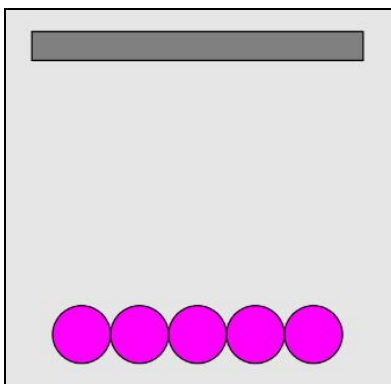
6. Modify the **rope class constructor** to accept the two bodies as inputs, and additionally offset positions as shown here.
   - Read up on the pointB property here and why it is important in this project: https://brm.io/matter-js/docs/classes/Constraint.html#property_pointB.

```
constructor(body1,body2, offsetX, offsetY)
{
    this.offsetX=offsetX
    this.offsetY=offsetY
    var options={
        bodyA:body1,
        bodyB:body2,
        pointB:{x:this.offsetX, y:this.offsetY}
    }
    //console.log(options);
    this.rope=Constraint.create(options)
    World.add(world,this.rope)
}
```
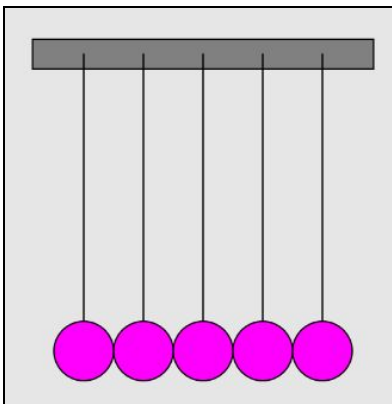
7. Add a rope between every bob and the roof, using the **rope class.**

```
rope1=new rope(bobObject1.body,roofObject.body,-bobDiameter*2, 0)
```

8. Make sure the individual bob objects are connected to a point on the roof, vertically above the center of each bob.

9. Make sure the project works before you submit it.
*Refer to the images given above for reference.

Submitting the Project:

1. Upload your completed project to your own github account.
2. Create a new repository named "**Project 27**".
3. **Upload** working code to this github repository.
4. Enable Github pages for the repository.
5. Copy the link to the github pages link in the Student Dashboard.

Hints for the Main Goal:

1. To arrange the **bobObjects** horizontally ensure that the distance between the centers of subsequent bob objects is equal to the diameter of the objects. Put the 3rd bob object below the center of the Roof, and adjust the ones on the left and right of the central pendulum accordingly.
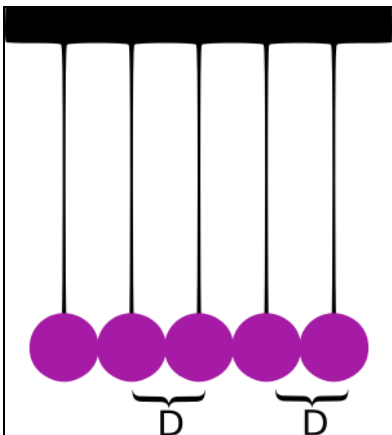
2. Use the same logic to determine where the other end of the constraint will be placed on the roof object.
   - **If you see your project like the image shown below on the left, it is wrong.** Here all the points in the constraint are pointed to the center of the roof.
   - Modify the positions of the anchor points on the roof by using the PointB property of the constraint.
     - **Remember the *pointB* property is** not the position where the constraint will be anchored to, but **how much away is the point from the center of the body.** See the **code given in the image on the right** to understand this better.
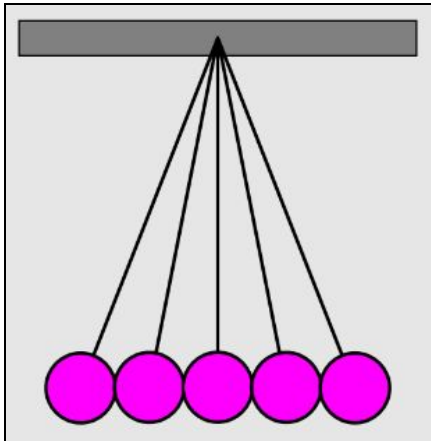
```
constructor(body1,body2, offsetX, offsetY)
{
    this.offsetX=offsetX
    this.offsetY=offsetY
    var options={
        bodyA:body1,
        bodyB:body2,
        pointB:{x:this.offsetX, y:this.offsetY}
    }
    //console.log(options);
    this.rope=Constraint.create(options)
    World.add(world,this.rope)
}
```

3. Drawing a line to depict the string holding the bob can be done in the rope class as follows:

```
display()
{
    var pointA=this.rope.bodyA.position;
    var pointB=this.rope.bodyB.position;

    strokeWeight(2);

    var Anchor1X=pointA.x
    var Anchor1Y=pointA.y

    var Anchor2X=pointB.x+this.offsetX
    var Anchor2Y=pointB.y+this.offsetY

    line(Anchor1X,Anchor1Y,Anchor2X,Anchor2Y);
}
```
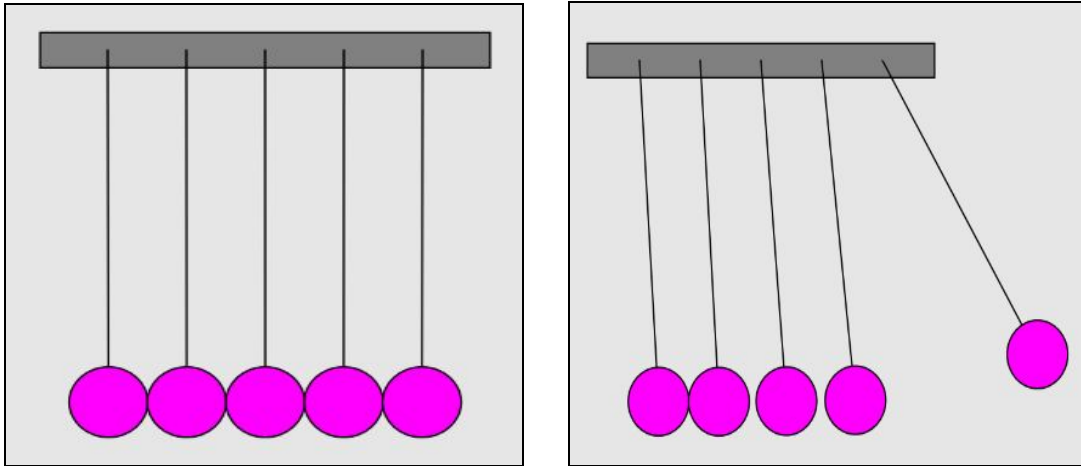
Additional Goal 1:

Now write code to add gravity and collide bobs with each other.

Specific Tasks to Achieve Additional Goal 1:

1. When the up arrow key is pressed ensure that the bob on the left goes up against gravity and falls down.
   - Applying a force to it in the left direction will ensure it rises and then falls.
   - See video [here](#).
2. Make sure the project works before you submit it.

*SAVE all the changes made to the project and **SUBMIT** the shareable link in the Student Dashboard Projects panel against the correct class number.

REMEMBER... Try your best, that's more important than being correct.
After submitting your project your teacher will send you feedback on your work.

———————— xxx ———————— xxx ———————— xxx ———————— xxx ———————— xxx ————————