**PHYSICS 2021 - 22 November 30, 2021**

**Today’s Agenda (Day 64)**

1. HOUSEKEEPING ITEMS

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1. HOMEWORK CHECK:

🡪 Lab Report: Rocket Project

 🡪 Self-Reflection: Rocket Project

1. CLASS ACTIVITY

🡪 TEST: Chapter 10

 \*Go to [www.socrative.com](http://www.socrative.com) 🡪 enter room “MSBPHYSICS” 🡪 enter ID #

HOMEWORK:

* READ: Chapter 11 – Energy and Its Conservation
* COMPLETE: Chapter 12 Vocabulary
* COMPLETE: Lab Report for Water Bottle Rocket Project AND Self-Reflection Questions
* STUDY: Chapter 11 Vocabulary AND Test

<http://glencoe.mheducation.com/sites/0078807220/student_view0/self-check_quizzes.html>

Chapter 11: Energy and Its Conservation

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| --- | --- | --- | --- | --- |
| Rotational kinetic energy | Gravitational potential energy | Elastic potential energy | Law of conservation of energy | Inelastic collision |
| Potential energy | Reference level | Thermal energy | Mechanical energy | Elastic collision |

Chapter 12: Thermal Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Conduction | Thermal equilibrium | Heat | Convection | Radiation | Specific heat |
| Heat of fusion | Heat of vaporization | First law of thermodynamics | Heat engine | Entropy | Second law of thermodynamics |

REMINDERS:

* **~~TEST: Chapter 10 & Vocabulary 🡪 Nov. 30~~**
* ~~Self-Reflection: Water Bottle Rocket – Nov. 30~~
* Lab Report: Water Bottle Rocket – Dec. 1
* Chapter 12 Vocabulary – Dec. 2
* **TEST: Ch 11 & Vocab🡪 Dec. 7**
* **TEST: Ch 12 & Vocab 🡪 Dec. 9**
* **Midterm Exam:** Chapters 1 - 13

**PHYSICS 2021 - 22** CHAPTER REVIEW

**PRACTICE PROBLEMS 11.1**

1. A 52.0 kg skater moves at 2.5 m/s and glides to a stop over a distance of 24.0 m. Find the skater’s initial kinetic energy. How much of her kinetic energy is transformed into other forms of energy by friction as she stops? How much work must she do to speed up to 2.5 m/s again?
2. An 875.0 kg sub-compact car speeds up from 22.0 m/s to 44.0 m/s. What are the initial and final kinetic energies of the car? How much work is done on the car to increase its speed?
3. A comet with a mass of 7.85 x 1011 kg strikes Earth at a speed of 25.0 km/s. Find the kinetic energy of the comet in joules, and compare the work that is done by Earth in stopping the comet to the 4.2 x 1015 J of energy that was released by the largest nuclear weapon ever exploded.
4. A 2 kg wheel rolls down the road with a linear speed of 15 m/s. Find its translational and rotational kinetic energies. (Hint: I = mr2)
5. If you slowly lower a 20.0 kg bag of sand 1.20 m from the trunk of the car to the driveway, how much work do you do?
6. A worker picks up a 10.1 kg box from the floor and sets it on a 1.1 m high table. He slides the box 5.0 m along the table and then lowers it back to the floor. What were the changes in the box-earth system’s energy, and how did the system’s total energy change? (Ignore friction.)
7. You get a spring-loaded jumping toy ready, compressing the spring. The toy then flies straight up. Draw bar graphs that describe the forms of energy present in the following instances. Assume the system includes the spring toy and earth.
8. The toy is pushed down thereby compressing the spring.
9. The spring expands and the toy jumps
10. The toy reaches the top of its flight.
11. A 90.0 kg rock climber climbs 45.0 m upward, then descends 85.0 m. The initial height is the reference level. Find the potential energy of the climber-earth system at the top and at the bottom. Draw bar graphs for both situations.

**PRACTICE PROBLEMS 11.2**

1. A bike rider approaches a hill at a speed of 8.5 m/s. The combined mass of the bike and the rider is 85.0 kg. Choose a suitable system. Find the initial kinetic energy of the system. The rider coasts up the hill. Assuming friction is negligible, at what height will the hike come to rest?
2. A skier starts from rest at the top of 45.0 m high hill, skis down a 30⁰ incline into a valley, and continues up a 40.0 m high hill. The heights of the both hills are measured from the valley floor. Assume that friction is negligible and ignore the effect of the ski poles.
3. How fast is the skier moving at the bottom of the valley?
4. What is the skier’s speed at the top of the second hill?
5. Do the angles of the hill affect your answers?
6. In a belly-flop diving contest, the winner is the diver who makes the biggest splash upon hitting the water. The size of the splash depends not only on the diver’s style, but also on the amount of kinetic energy the diver has. Consider a contest in which each diver jumps from a 3.00m platform.

One diver has a mass of 136 kg and simply steps off the platform. Another diver has a mass of 100 kg and leaps upward from the platform. How high would the second diver have to leap to make a competitive splash?

1. The spring in a pinball machine exerts an average force of 2N on a 0.08 kg pinball over 5 cm. As a result, the ball has both translational and rotational kinetic energy. If the ball is a uniform sphere (I = 5/2 mv2), what is its linear speed after leaving the spring? (Ignore the table’s tilt.)
2. An 8.00 g bullet is fired horizontally into a 9.00 kg block of wood on an air table and is embedded in it. After the collision, the block and bullet slide along the frictionless surface together with a speed of 10.0 cm/s. What is the initial speed of the bullet?
3. A 91.0 kg hockey player is skating on ice at 5.50 m/s. Another hockey player of equal mass, moving at 8.1 m/s in the same direction, hits him from behind. They slide together.
4. What are the total mechanical energy and momentum of the system before the collision?
5. What is the velocity of the two hockey players after the collision?
6. How much was the system’s kinetic energy decreased in the collision?
7. A child jumps on a trampoline. Draw bar diagrams to show the forms of energy present in the following situations.
8. The child is at the highest point.
9. The child is at the lowest point.
10. As shown in Figure 14, a child slides down a playground slide. At the bottom of the slide, she is moving at 3.0 m/s. How much energy was transformed by friction as she slid down the slide?



**PHYSICS 2021-22 Lab Activity**

**Physics Water Bottle Rocket Competition**



**http://aplusphysics.com/projects/water\_rockets.html**

**Event Description:** Teams of two or three people will build a water bottle rocket that will stay and can be vertically-launched AND horizontally-launched into the air for a maximum amount of time

**Specifications:**

1. Rockets are to be constructed from a 2-liter soda bottle.
2. The soda bottle must remain intact.
3. Additional materials such as fins, nose cones, parachutes, etc. are permitted, within reason.
4. The bottle will have water and 40 psi of compressed air put into it. When the pressure is released, the rocket should fly.
5. Launcher should be able to accommodate both a vertical and horizontal launch of the water bottle rocket. Launcher cannot be hand-held during pressure-infusion.

**Resources**:

* [All About Water Rockets](http://exploration.grc.nasa.gov/education/rocket/BottleRocket/about.htm)
* [Hayhurst's Quick and Easy Bottle Rockets](http://www.lnhs.org/hayhurst/rockets/)
* [Water Bottle Rockets](http://home.comcast.net/~timhesterberg/WaterRockets.html)
* [Water-Powered Bottle Rocket](http://www.tclauset.org/21_BtlRockets/BTL.html)
* [Rockets Away Software Demo](http://extension.osu.edu/rockets/cgi-bin/design_zone.cgi)
* [Principle of the Rocket](http://www-istp.gsfc.nasa.gov/stargaze/Srocket.htm)
* [Sim Water Rocket](http://www.et.byu.edu/~wheeler/benchtop/sim.php)
* [Bottle Rocket Construction](http://sections.asme.org/sandiego/Meetings/waterrocketconstruction.pdf)
* [Bottle Rocket Launcher Construction](http://users.soe.ucsc.edu/~karplus/abe/soda-bottle-rocket.pdf) (provided by instructors for project)
* [Cadre Water Rocket](http://alain.juge.pagesperso-orange.fr/English/EnFrame.htm)

**Procedure**:

1. Get into groups of 3.

2. Research how to design and construct a water bottle rocket, pressure-driven from reliable resource.

3. Agree on a design, where and when to construct apparatus.

4. Gather materials.

5. Begin assembly. Be mindful of all safety precautions and use all necessary safety gear (ie. eye goggles, etc).

6. Using your safety gear, test functioning of constructed apparatus (rocket launcher with “rocket”); be sure that you have the “trigger” that can release from a **safe** distance away! Ensure that your device can undergo multiple launches without breakdown of its foundation. **PREPARE THREE ROCKETS!!**

7. Bring apparatus to school at scheduled date, as per teacher’s notification. BRING BOTH ROCKETS & LAUNCHER ON DAY OF COMPETITION!

**\*Capture the step-by-step process via still photos or video!**

**\*Completed product must be a representative product of your age-level, knowledge and skills set!**

**POST-ACTIVITY**

**Team Reflection:** As a team, submit your answers to the following questions:

1. Analyze your rocket's motion:
	1. How long was your rocket in the air?
	2. Estimate your rocket's maximum height. Show and explain all calculations.
	3. What was your rocket's maximum velocity? Show and explain all calculations.
2. Did you have to do anything/employ different concepts to ensure that your rocket could be launched bi-directionally?
3. What role did friction play in the performance of your rocket? Did it aid or hinder? Explain.
4. Beginning with the stored mechanical energy in the pressurized rocket, explain the multiple transformations the energy goes through. See Unit II of Physics Textbook.
5. How did undertaking this project improve your understanding of work and energy?
6. How did you feel about this project when it was first assigned?
7. How do you feel about this project now that it has concluded?
8. What would you have done differently as you and your team worked through this project?

**Scoring:** Scoring will be based 50% on rocket performance, 50% on your team's reflection.

## **SELF-REFLECTION ON LEARNING**

Spend a few minutes to analyze your performance on group and individual tasks.

|  |  |
| --- | --- |
| **Name:** |  |
| **Project Name:** |  |
| **Describe the project in a sentence or two:** |  |
| **What is the most important thing you learned during this project:** |  |
| **What do you wish you had spent more time on:** |  |
| **What big idea(s) did this project help you understand?** |  |
| **What do you wish you had done differently:** |  |
| **What part of the project did you do your best work on:** |  |
| **What was the most enjoyable part of this project:** |  |
| **What was the least enjoyable part of this project:** |  |
| **How could your teacher(s) change this project to make it better next time:** |  |