Advanced Physics Summer Assignment
IB Physics 2
AP Physics 2

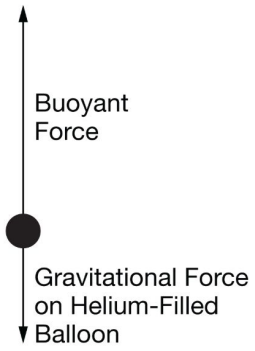
This summer assignment is meant to review essential knowledge and skills that you should have learned in your previous science classes. Your understanding and ability to apply these couple of concepts will help you in your second year of Physics. Do your best to complete all these questions and explain all answers when necessary. These concepts will be reviewed the first day of school in September.

Section 1 - All the measurements below have a prefix on their unit. Convert each value to its base unit. For instance the base unit for time is a second. So if you measured something to be 700 ns (nanoseconds) it would be equivalent to 700×10^{-9} seconds.

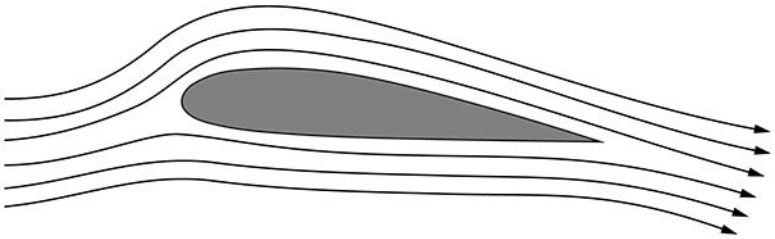
1. 35 cm
2. 8.9 µC
3. 800 mg
4. 35000 kPa
5. 4400 cm^3
6. 76 MJ

Section 2 - Complete the following questions which relate to topics you will learn in advanced physics. Despite the content being new, all of these questions require you to only have an understanding and be able to apply your knowledge of forces and energy. Do you best to answer each question, for the multiple choice questions make sure to explain the reasoning for your answer choice.

1. The free body diagram diagram shows an upward Buoyant Force of 3 N and a downward gravitational force of 1N. The mass of the balloon is 0.1 kg. What is the acceleration of the balloon?



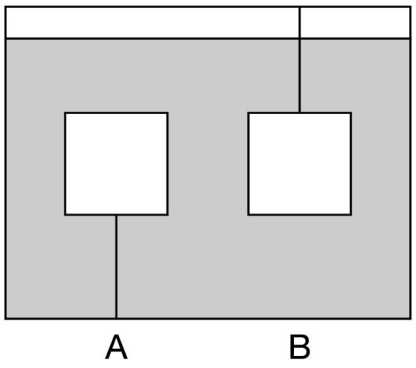
2. A student is modeling the flow of air around an airplane wing, as shown in the figure. The model assumes that the air behaves like a fluid. Which of the following can exert an upward force on the wing?



a. The gravitational force on the wing
b. The difference in the normal forces exerted on the wing by the air above and below the wing
c. The difference in the force exerted by the air hitting the front of the wing and the back of the wing
d. The frictional force between the air and the wing

Explain your reasoning for the answer you chose:

3. Two blocks attached to strings are at rest in a liquid, as shown. Let W be the magnitude of the weight of a block and T be the magnitude of the tension in a string. Since the net force on each block is zero, Newton's second law can be written in the form "the force exerted upward by the liquid equals some combination of W and T." Write out an expression for the upward force in terms of W and T for each block? (Hint: are you adding W+T or subtracting W-T)



Expression for block A:

Expression for block B:

4. A sample of gas is confined in a cylinder with a moveable piston of mass m that is initially held fixed. There is a block of mass $2m$ on top of the piston, as shown in the figure. A free-body diagram for the block is also shown, which includes the normal force F_N exerted on the block by the piston and the weight W_B of the block. The upward force that the gas exerts on the piston has magnitude F_{gas}. What is the acceleration of the block immediately after the piston is released?

A $(F_N - W_B)/2m$

B $(F_N - W_B)/3m$

C $(F_N + F_{gas} - W_B)/2m$

D $(F_N + F_{gas} - W_B)/3m$

Explain why you chose your answer:

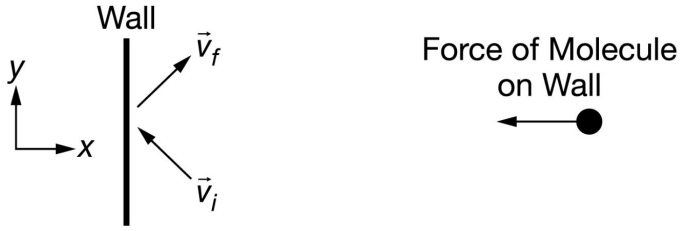
5. The figure shows the velocity vectors v_i and v_f of a gas molecule immediately before and immediately after the molecule collides with a container wall. The force exerted by the molecule on the wall during the collision is also shown. Which of the following correctly describes the magnitude a of the acceleration of the molecule during the collision with the container wall?

A $a = 0$

B $a = \frac{v_x}{\Delta t}$

C $a = \frac{2v_x}{\Delta t}$

D $a = \frac{v_f - v_i}{\Delta t}$



Explain the reasoning for your answer:

6. A 15 kg shopping cart is initially at rest. A person pushes the cart with a constant force of 25 N in the direction of motion over a distance of 4m.
    a. How much work was done by the person?

    b. What velocity would you expect the cart to be moving after the push?

    c. If the cart was only travelling at 3 m/s after the push, how much Kinetic Energy does it have?

    d. Explain why your expected value for the velocity is different than the actual velocity?

7. In the diagram to the right two charged objects experience a force only due to each other. The positive charge is getting pulled to the right with a 0.08N force. Explain what force the negative charge will experience and how you know.