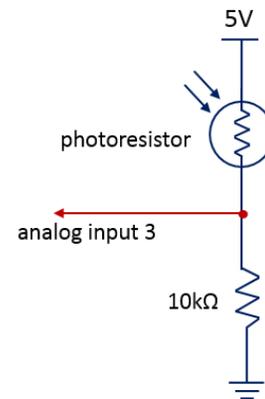


NOTE: Use engineering format for problems 1 through 4. Use non-engineering format for problem 5. This is an individual assignment.

- At a new waterpark, a giant animatronic whale spews water out of the whale's spout at people walking around the park. The water moves at a speed of 0.15m/s. Over the 2-minute period that the pump runs, 22086kg of water is released. The spout is located 40 feet above the pump outlet (which is at the surface of the water reservoir) and has known pump efficiency of 50%. What is the electrical power required to run the pump?
 $P=44kW$
- A chemical engineering plant stores a fluid that has a density of 1050kg/m³ in a holding tank. The hose which is connected to the pump that is moving the liquid into the tank has an inside diameter of 3.8in. The top surface of the reservoir where the liquid is waiting to be pumped into the holding tank is 8.4m below the exit tube connected to the pump. If the tank holds 5000kg of the liquid and takes 0.75hr to be filled, what is the exit velocity of the fluid entering the tank? $v=0.241m/s$
- The equation below is used to compute the voltage at analog pin 3 on an Arduino Uno, storing the computed voltage as an integer in a variable named **voltage_val**. Find

```
int voltage_val = analogRead(3) / 1023 * 5;
```

- voltage_val** when the **analogRead(3)** function returns 621. $voltage_val = 3V$
 - The value returned by **analogRead(3)** when the voltage at pin 3 is 4V. $analogRead(3) = 818$
- Consider the photoresistor circuit shown.
 - If the **analogRead(3)** function returned a value of 458, what is the voltage drop across the 10k Ω resistor and what is the voltage drop across the photoresistor? $\Delta V_{10k\Omega} = 2.24V$, $\Delta V_{photo} = 2.76V$
 - If the voltage drop across the 10k Ω resistor is 3.2V, what value will be returned by the **analogRead(3)** function?
 $analogRead(3) = 654$
 - If the voltage drop across the photoresistor is 4.1V, what is the resistance value of the photoresistor? $R = 45555.6\Omega$
 - If the **analogRead(3)** function returns a value of 745, what is the total current passing through the circuit? $I = 0.36mA$



- Using the Internet and any other resources, briefly investigate the history of human population starting as far back as you wish to go (but at least to 0 A.D.). Write a paragraph in your own words describing what you have learned. We expect you to spend between 15 minutes and 30 minutes looking into this issue to provide background for an in-class discussion; extensive research is not expected since you are working on several larger assignments.

Reminders:

- Your pump project is due on class 18. While time will be allotted during class 17 (the next class) for pump testing, you can also test your pump during helpdesk hours. To test at the helpdesk, you will need to sign up by choosing a time slot on the sheets taped to the helpdesk door. Refer to the "pump project requirements" for details of what should be submitted.
- Please continue to work on the robotics challenge which will be held during class 19. Refer to Class 8 for more information on the robot challenge.