Exam Practice Problems (3 Point Questions)

Below are practice problems for the three point questions found on the exam. These questions come from past exams as well additional questions created by faculty. Some of the queston below appear as fill-on-the-blank. These were taken from previous iterations of the ENGR 121 Exam. Your test will consist of only multiple choice. Please note that these are just examples of questions and may not cover all concepts that could be asked in the 3 point section on your exam.

Programming & LCD

1. In class, you used a transistor to make an LED turn light up by issuing certain commands from your Arduino. Which of the commands below is one that would be essential?
   a. digitalRead()
   b. digitalWrite()
   c. Serial.begin()
   d. servo()
   e. analogRead()
   f. analogWrite()
   g. Serial.print()

2. When using the LCD to display the status of your fishtanksystem, information is sent to the LCD from the Arduino using . . .
   a. an analog pin configured as an input
   b. an analog pin configured as an output
   c. a digital pin configured as an output
   d. a digital pin configured as an input
   e. the USB cable

3. What would an LCD read if you created an Arduinosketch using the given code. You may assume that the code is working correctly.
   a. 254
   b. 131
   c. 197
   d. 212
   e. Louisiana Tech
   f. University
   g. i =   x =
   h. e, f, and g only
   i. All of the above
   j. None of the above

```
#include <SoftwareSerial.h>
  SoftwareSerial mySerial(3,2);
void setup() {
  mySerial.begin(9600); delay(500);
  mySerial.write(254);  mySerial.write(1);
  mySerial.write(254);  mySerial.write(131);
  mySerial.write("Louisiana Tech");
  mySerial.write(254);  mySerial.write(197);
  mySerial.write("University");
  mySerial.write(254);  mySerial.write(212);
  mySerial.write("i=    x=");
}
```

Transistors

4. The C, B, and E probes on a transistor stand for
    a. Curve, Boss, and Extrude
    b. Create, Bevel, and Exclude
    c. Count, Become, and Evolve
    d. Collector, Base, and Emitter
    e. Capture, Begin, and Elude
    f. Convey, Broadcast, and Eliminate
    g. Cancel, Bend, and Erase
    h. Collect, Blend, and End

5. The most popular semiconductor base material is
    a. Boron
    b. Phosphorus
    c. Calcium
    d. Iodine
    e. Carbon
    f. Silicon
    g. Neon
    h. Argon
    i. Aluminum

6. When impurities are intentionally introduced into a material to change its conductive properties, it is called _____.

7. The two semiconductor doping elements discussed in class are _____ and _____. They have ___ and ___ valence electrons, respectively.
    a. Silicon, Boron, 4, 4
    b. Silicon, Phosphorus, 4, 3
    c. Calcium, Silicon, 2, 4
    d. Phosphorus, Boron, 5, 3
    e. Carbon, Phosphorus, 4, 5
    f. Calcium, Boron, 2, 3
    g. Carbon, Boron, 4, 3
    h. Silicon, Aluminum, 4, 3
    i. Boron, Aluminum, 3, 3

8. Identify two doping agents commonly used to make a transistor:
    a. boron & silicon
    b. bromine & platinum
    c. phosphorus & silicon
    d. platinum & boron
    e. boron & phosphorus
    f. all of the above
    g. none of the above

9. The base material used for most semiconductors is _____ (the name of the atom that forms the main ingredient of semiconductors).

10. In class, we talked about doping a semiconductor with phosphorus (5 valence electrons) and with boron (3 valence electrons). Doping with boron will cause the resulting semiconducting material to have a missing electron which is often called a _____.
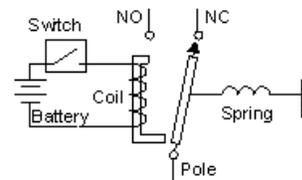
Relays

11. Identify the type of relay used for the fish tank project:
    a. SPST
    b. SPDT
    c. DPST
    d. DPDT
    e. all of the above
    f. none of the above

12. The relay in the diagram is an example of which type?
    a. SPST
    b. SPDT
    c. DPST
    d. DPDT

13. Where does the power come from that is used to energize the coils on your relays on the fish tank system (if you hook it up as shown in the notes)?
    a. directly from an Arduino pin
    b. from the 5V voltage regulator on the Arduino
    c. from a 12V power supply plugged into an electrical outlet
    d. from an analog input pin on the Arduino
   e. from the solenoid valve

14. What type of relay is depicted in this image? _____ pole _____ throw

15. The power used to energize the coil on the relay (thus closing the contacts) comes from which source? Please be very specific.

Fishtank Fabrication

16. The body of the conductivity sensor (the part water flows through) is made of . . .
    a. PVC
    b. ultra high molecular weight polyethylene
    c. stainless steel
    d. nylon
    e. ABS

17. The rod used to make the metal probes for the conductivity sensors was made from
    a. Aluminum
    b. Copper
    c. Iron
    d. Polyethylene
    e. Stainless steel
    f. PVC

18. The object shown to the right was used when you fabricated the wooden fishtank platform. It is called a _____ _____. (provide the two words used in the PowerPoint presentation if you know them).
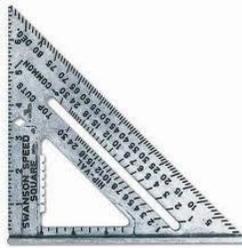

19. The black screws used to join the wooden pieces together when fabricating the fishtank platform are called _____ screws.

20. Ultra High Molecular Weight Polyethylene was used to fabricate the conductivity sensors. The PowerPoint presentation showed that polyethylene molecules are long, chain-like molecules made from what two atoms? _____ and _____

21. The 1/16 inch diameter rod used to make the metal probes for the conductivity sensors was made from 316 _____ _____.

22. The process of cutting internal threads is called _____ing. You performed this operation when you cut threads into your fishtank and into your conductivity sensor.

23. You used two liquids to bond the PVC cap to the 3-inch long PVC pipe segment when making you fishtank. What was the purpose of the first liquid that was applied?

24. Use SolidWorks to draw the assembly shown. (You will not have to draw on SolidWorks for your exam, but be prepared to answer questions about drawing the fishtank in SolidWorks)

cap: 2 inch outer radius, 1.5 inch inner radius, 2 inches tall, 1.5 inches deep (the bottom is ½ inch thick)
tube: 1.5 inch outer radius, 1 inch inner radius, 4 inches tall
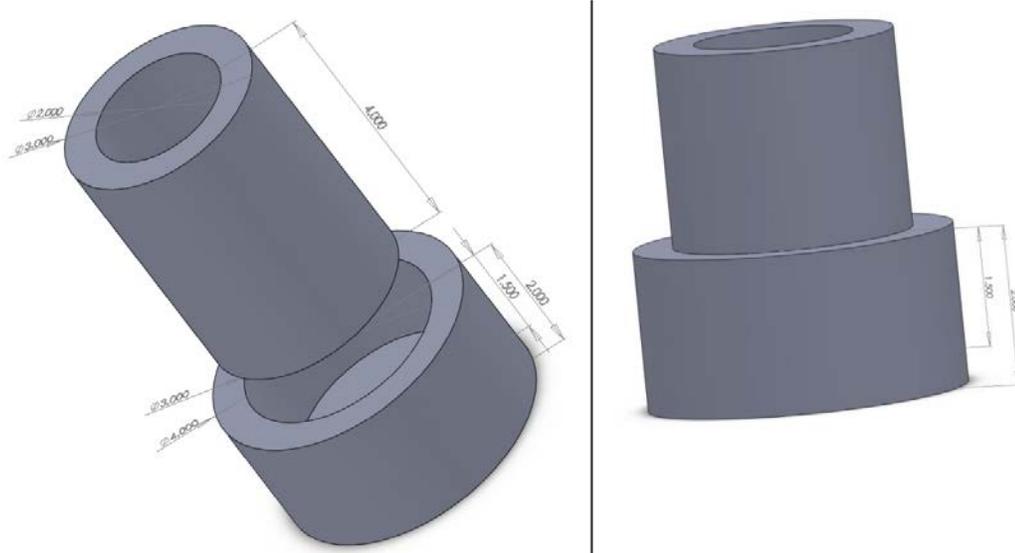
Incorporate the fitting shown into the fishtank assembly. Cut a hole into the "fishtank" for the fitting to pass through.
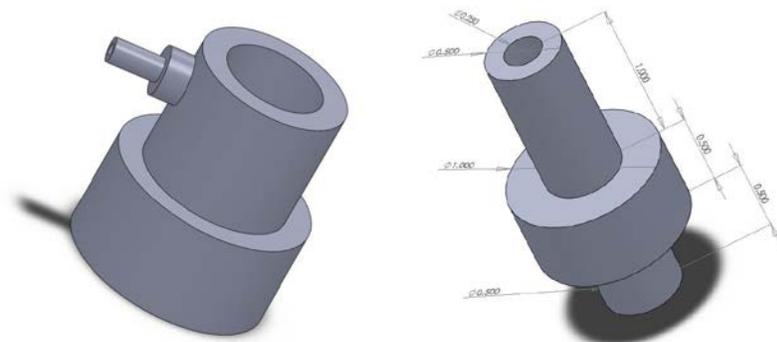
System Control
25. Using the control recommendations in the notes on the website, how much below the setpointis the LCL?
    a. Half a standard deviation of the measurement error
    b. One standard deviation of the measurement error
    c. Two standard deviations of the measurement error
    d. Three standard deviations of the measurement error
    e. Four standard deviations of the measurement error
    f. Half of the gain of the measurement error
    g. Half the deadtimecompensation

26. The difference between the UCL and the LCL is called the _____band.

27. How far above the setpoint is UCL? Provide a one sentence answer.

Conservation of Energy

28. We also called "conservation of energy" the "1st Law of _____."

29. Conservation of energy is also known as the first law of
    a. Motion
    b. Physics
    c. Energy
    d. Nature
    e. Robotics
    f. Equilibrium
    g. Thermodynamics
    h. Alchemy
    i. Witchcraft

30. The temperature of a 5 kg sample of an unknown material increases by 12°C when it absorbs 1,500 J of energy. The specific heat of the material is closest to …
    a. $25 \, J/(kg°C)$
    b. $124.58 \, J/(kg°C)$
    c. $297.6 \, J/(kg°C)$
    d. $625 \, J/(kg°C)$
    e. $1,517 \, J/(kg°C)$
    f. $3,600 \, J/(kg°C)$
    g. $90,000 \, J/(kg°C)$

31. A 12VDC power supply powers a 40Ωresistance heater. Select the smallest power supply below that will sufficiently power the heater.
    a. 12V, 0.1A
    b. 12V, 0.2A
    c. 12V, 0.3A
    d. 12V, 0.4A
    e. 12V, 0.5A
    f. 12V, 0.6A
    g. 12V, 0.7
    h. 12V, 0.8A