

## QUIZ 2 – Summer 2013

NAME: \_\_\_\_\_

**Answer 5 of the 6 problems below. Put a large X through the problem you do not want us to grade. If there is no X, the first five problems will be graded.**

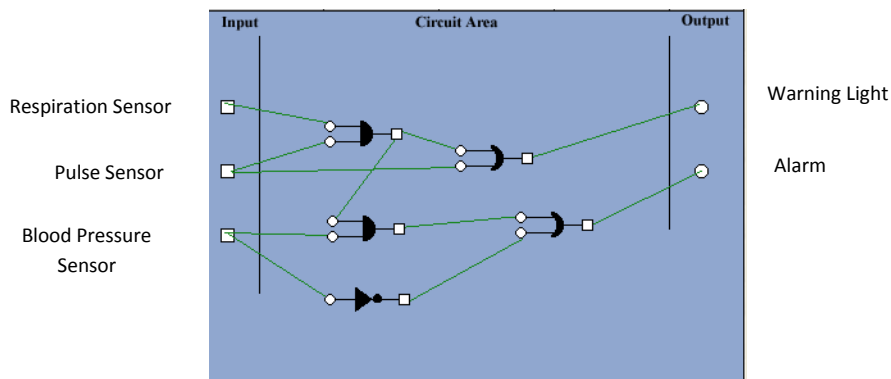
**Please read each question carefully. Some questions may have more than one answer.**

**You may use a standard or scientific calculator, your class notes, and any lecture handouts. You MAY NOT use a computer, laptop, or other Internet-connected device.**

**Question 1:** You have just received the circuit diagram for a new medical monitoring system for use in the operating room. In 10 minutes you need to make a presentation to your boss about how the warning light and alarm features on this device operate. The only information you received was the circuit diagram given in Figure 1 and the following description of each sensor.

The Respiration Sensor is activated when it detects a decrease in a patient’s respiration. The Pulse Sensor is activated when it detects an increase in the patient’s pulse, and the Blood Pressure Sensor is triggered when the patient’s blood pressure falls below a certain level.

Figure 1: Circuit



Below is a partial truth table for the circuit shown in Figure 1. Complete the missing outputs in the truth table. (1 pt for each blank)

Respiration Sensor	Pulse Sensor	Blood Pressure Sensor	Warning Light	Warning Alarm
0	0	0		1
0	0	1	0	0
0	1	0	1	
0	1	1	1	0
1	0	0		1
1	0	1	0	0
1	1	0	1	1
1	1	1		

**Question 2:** Another company offers a product that competes with the system presented in Question 1. The truth table for the competing system is given below.

Respiration Sensor	Pulse Sensor	Blood Pressure Sensor	Warning Light	Warning Alarm
0	0	0	0	0
0	0	1	0	1
0	1	0	1	0
0	1	1	1	1
1	0	0	1	0
1	0	1	1	1
1	1	0	1	1
1	1	1	1	1

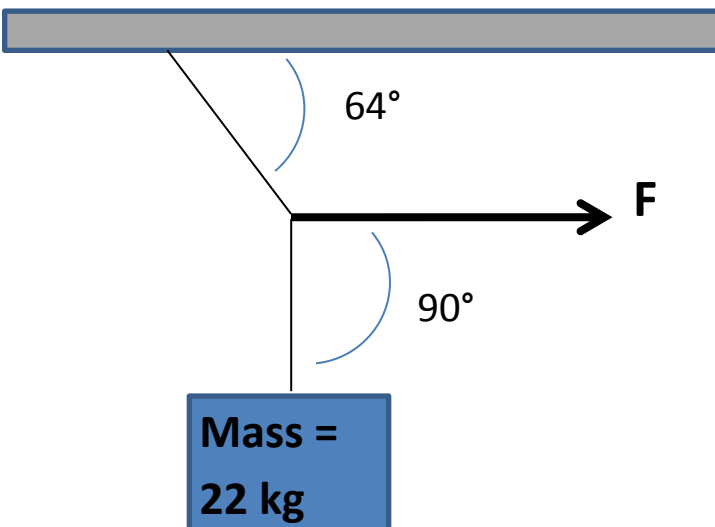
Circle every true statement below (there may be more than one correct answer):

- The warning light turns on every time the Respiration Sensor is activated.
- The alarm sounds every time the patient's blood pressure falls below a certain level
- Both the warning light and alarm turn on when two or more sensors are activated.
- Anytime only one sensor is activated the warning light turns on.
- Anytime only one sensor is activated either the warning light is illuminated or the alarm sounds.

**Question 3:** Complete each statement below by circling the correct answer.

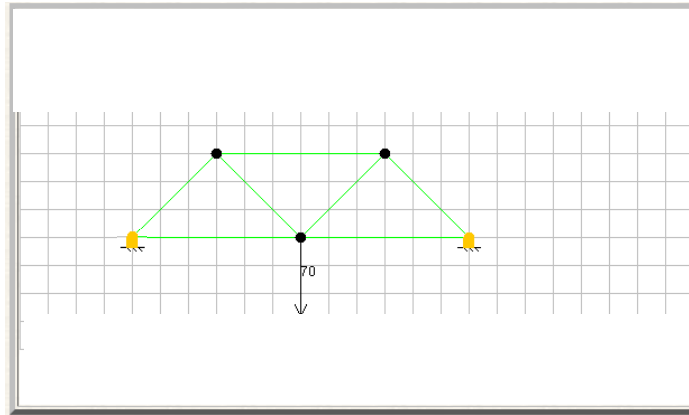
In the figure below you see a mass of 22 kg being held up by a length of rope. Complete the sentence below by circling the correct answer. (All answers are rounded to two significant figures.)

- The value of F in the diagram below is 105 N / 10.7 N / 240 N / 492 N.
- If you wanted to reduce the magnitude of F you should make the top angle larger than 64° / make the top angle less than 64°.



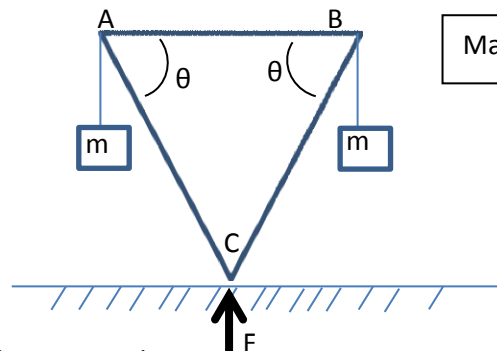
Problem 3 is continued on the next page

Consider the Bridge Builder truss figure below. Circle the letter in front of all true statements (there may be more than one)



- c. The Bridge Builder program will not be able to calculate the forces in each member of the truss because it is missing a rolling node.
- d. The Bridge Builder program will not be able to calculate the forces in each member of the truss because the ratio of nodes to members yields an unsolvable matrix.
- e. The Bridge Builder program will be able to calculate the forces in each member of this truss.

**Question 4:** You are evaluating the following two dimensional structure of an inverted isosceles triangle balanced on a solid surface and supporting two identical loads of mass,  $m$ . Angles  $CAB$  and  $ABC$  are both equal to  $\theta$ . Circle the letter in front of all the true statements below. You should assume that this structure is both well balanced and in static equilibrium. There may be more than one correct answer.

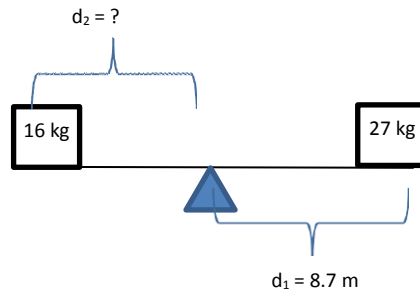


Mass of the structure is negligible

- a. Member AB is in compression
- b. Member AC is in compression
- c. Member BC is in compression
- d. The Force,  $F$ , acting at point C is equal to  $2mg$ .

Problem 4 is continued on the next page

Please consider the figure below. A mass of 27 kg is located at a distance,  $d_1$  of 8.7m from the fulcrum. Another mass of 16 kg is placed on the system a distance  $d_2$  from the center. Complete sentence b by circling the correct word. (All values have been rounded to 2 significant figures.)



- e. To achieve static equilibrium  $d_2$  must be 6.8m / 11m / 15m / 27m

**Question 5:** You are trying to determine the error in a volume calculation you performed on a rectangular rod of an unknown material. You measured the dimensions with the following uncertainties:

$$H = 5.4 \text{ cm} \pm 0.2 \text{ cm} \quad W = 3.8 \text{ cm} \pm 0.2 \text{ cm} \quad L = 15 \text{ cm} \pm 0.5 \text{ cm}$$

Circle the letters for all true statements. There may be more than one correct answer. All answers have been rounded to 2 significant figures.

- The absolute error in the volume calculation is  $39 \text{ cm}^3$ .
- The relative error in the volume calculation is  $0.13 \text{ cm}^3$ .
- The absolute error in the volume calculation is 0.13.
- The absolute error in the volume calculation is  $38 \text{ cm}^3$ .
- The true value for the volume of this rod is  $310 \text{ cm}^3$ .

**Question 6:** Circle the letter for each correct statement. There may be more than one.

- In engineering an error is a mistake.
- Using an instrument that has not been correctly calibrated is an example of systemic error.
- One type of random error is the incorrect use of an instrument.
- In engineering a random error is difficult to correct.
- The best and most experienced engineers do not worry about error.