Mr. Demick Name: _____

IED: Semester 1 Final Exam Review 2017 Answer Key

Ten Assignment Points: Due on Exam Day

Follow the directions for each question. Write in pencil only, and circle your answers. Be sure that you answer each question thoroughly, as you will not receive credit for vague or incomplete information. This exam is worth **100 points** (*5 extra credit*) and 20% of your final grade in this class. Do your best. You may use your IED formula sheet.

The first section (1-15) is Key Terms for Units 1-3. Answer all definitions according to the PLTW Key Terms lists. Mark each answer on the answer key (*30 points; 2 points each*). Example:

1. **Innovation**

a. A decorative pattern.

b. An improvement of an existing technological product, system, or method of doing something.

c. A process that repeats a series of steps over and over until the desired outcome is obtained.

d. A new product, system, or process that has never existed before, created by study and experimentation.

2. **Caliper**

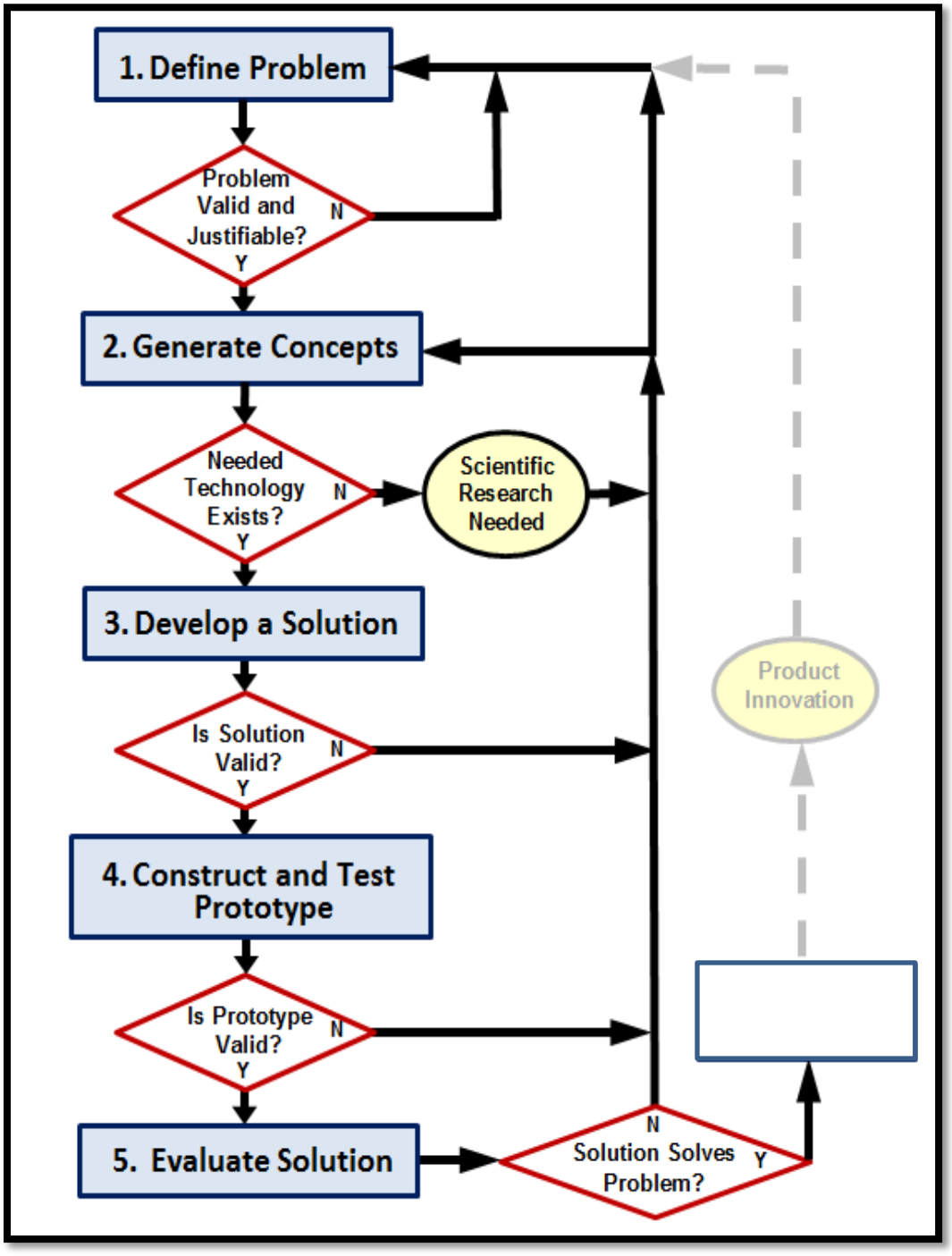
a. A measuring instrument having two adjustable jaws typically used to measure diameter or thickness.

b. A straight-edged strip of rigid material marked at regular intervals and used to measure distances.

c. An endangered South American bird known to prey on smaller birds and reptiles.

d. A graph of vertical bars representing the frequency distribution of a set of data.

16. In the flow chart below of the **design process**, fill in the phrases in the six header boxes. (*10 points*).



17. **Human-Powered Flight Design Brief** (i.e., the Gossamer Condor Design Brief) (10 points)

Requirements: The project will be considered successful when the plane can travel one mile under human power (using only the materials provided). The materials for the plane can only be mylar film, duct tape (seven rolls), 2" diameter aluminum poles, wire, and screws. The driver must also be able to steer the plane.

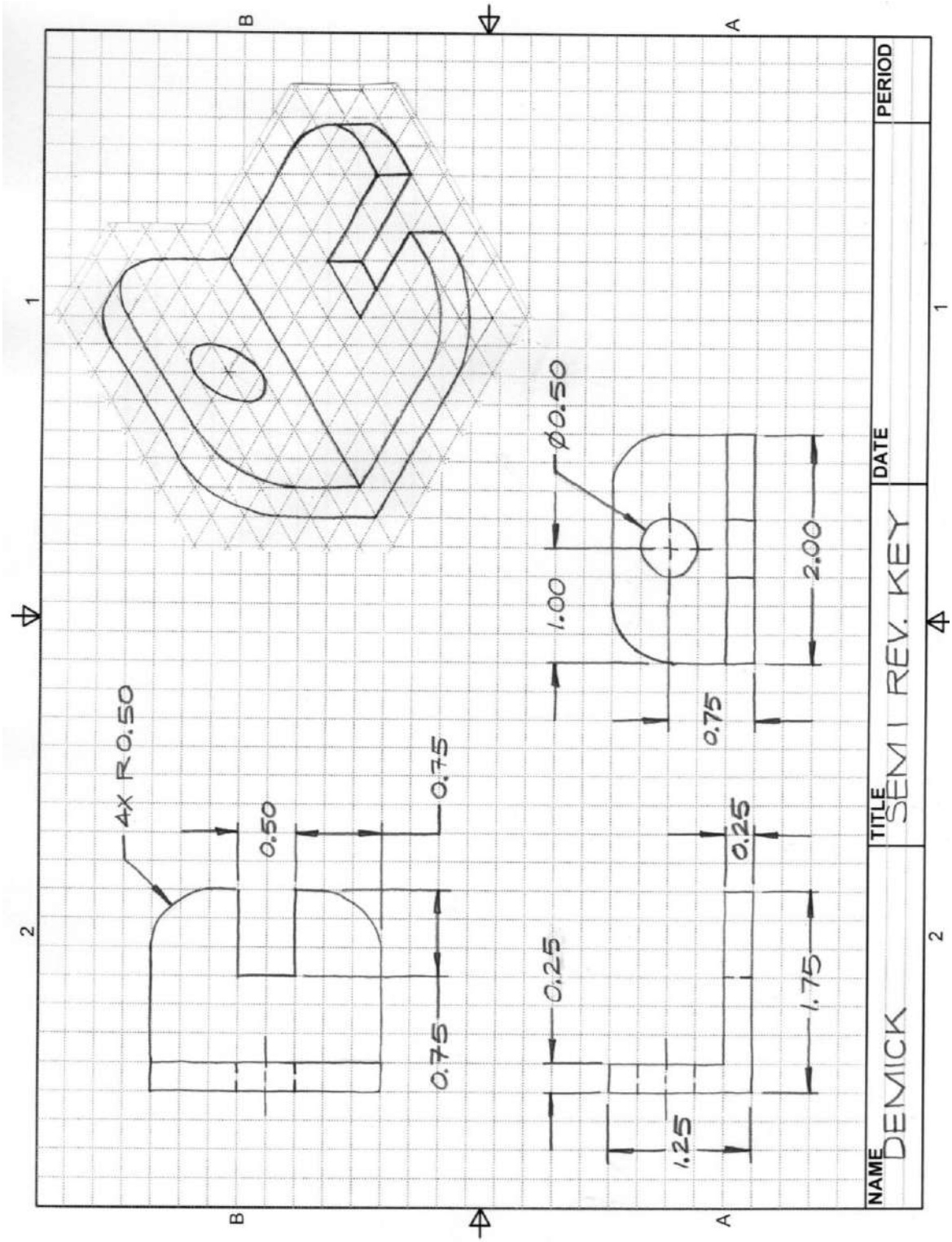
Conditions: You are part of a design team that is attempting to build a human-powered plane. The project leader has given you the responsibility of defining the problem, stating the expectations that the solution must meet, and identifying the project constraints. **Your design brief will serve as a guide to the team as they work through the design process. Complete your design brief in the spots below with a lot of detail.**

Below is a sample of a completed design brief for human-powered flight:

Gossamer Condor Design Brief

Designer:	Paul MacCready
Problem Statement:	No human-powered aircraft has ever been developed that could truly fly or win the Kremer Prize.
Design Statement:	Design, build, and test a controlled, sustainable human-powered aircraft that meets the criteria set forth by the Royal Aeronautical Society for the Kremer prize.
Constraints:	1. Maximum 1/3 horsepower human engine output 2. Unassisted take-off 3. Able to ascend to a height of at least 10 feet 4. Must fly a continuous distance of at least one mile around two pylons placed ½ mile apart 5. Capable of making complete left and right turns 6. After a full mile-long flight, must ascend again to a height of at least 10 feet

18. From the isometric drawing below, draw a three-view, **fully-dimensioned** multiview drawing **in pencil**. Include all features (object, hidden, and center lines) and all dimensions in their proper places and ½-inch apart (2 grid lines). Place point "A" at the indicated markers for each view. (*25 points*).



19. On the lines below, write on two assignments or activities in this class—INTRODUCTION TO ENGINEERING DESIGN. Describe the activities, what you enjoyed about them, and what you learned from them. Write in complete sentences with proper grammar. (*5 points*)

These answers will be different for each student.

Practice writing your own before the test.

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20. Complete the unit conversion problems below, showing all work and conversion factors. Write in pencil and circle your answers. No credit will be given for just an answer. (*15 points*)

A. A village on an island in the South Pacific was devastated by a tidal wave. The supply of fresh water was contaminated when the storm surge washed over the island, inundating the wells. Several tanks of fresh water were delivered to the village. Each tank contains 9.0 hectoliters of water. (*5 points*)

a. How many liters of water does each tank contain?

$$9.0\,hL \cdot \frac{10^2\,L}{1\,hL} = \boxed{900\ L}$$

b. On any given day, one person needs an average of 2.8 liters of water to survive. How many *people* will a tank supply for the day? Hint: Create a conversion factor to convert from liters to people.

$$900L \cdot \frac{1P}{2.8L} = \frac{900}{2.8}P = \boxed{321\ People/Day}$$

c. If the village (which includes people and livestock) requires a total of 410 liters of water each day, approximately how long (in *days*) will one tank provide an adequate supply for the village? Give your answer to the nearest tenth of a day. Hint: Create a conversion factor to convert form liters to days.

$$900L \cdot \frac{1D}{410L} = \frac{900}{410}D = \boxed{2.2\ Days}$$

B. A European car manufacturer reports that the fuel efficiency of the new MiniMini is 30.0 km/L highway and 22.0 km/L city. (*5 points*)

a. What are the equivalent fuel efficiency rates in miles per gal?

$$30\,\frac{Km}{L} \cdot \frac{0.621\,mi}{Km} \cdot \frac{L}{0.264\,g} = \frac{(30)(0.621)}{0.264}\,mpg = \boxed{70.6\ mpg}$$

$$22\,\frac{Km}{L} \cdot \frac{0.621\,mi}{Km} \cdot \frac{L}{0.264\,g} = \frac{(22)(0.621)}{0.264}\,mpg = \boxed{51.75\ mpg}$$

b. If gas costs $1.90 per gal, how much would it cost to drive 300 miles in the city in this car?

$$300\text{mi} \cdot \frac{\text{gal}}{51.75\text{mi}} \cdot \frac{\$1.90}{\text{gal}} = \frac{\$(300)(1.90)}{51.75} = \boxed{\$11.01}$$

C. Convert each of the following quantities to the indicated units. (*5 points*)

K h d [m] d c m

a. 11,520 milliliters to liters. Report to the nearest hundredth of a liter.

$$11{,}520\text{mL} \cdot \frac{\text{L}}{10^3\text{mL}} = \boxed{11.52\text{L}}$$

b. 7.42 yards to feet.

$$7.42\text{yd} \cdot \frac{3\text{ft}}{\text{yd}} = \boxed{22.26\text{ft}}$$

c. 0.65 feet to inches.

$$0.65\text{ft} \cdot \frac{12\text{in}}{\text{ft}} = (0.65)(12) = \boxed{7.8\text{in}}$$

d. 9 ft – 3 ½ in. to inches. Report answer using fractional inches.

$$9\text{ft} \cdot \frac{12\text{in}}{\text{ft}} + 3\tfrac{1}{2} = 108 + 3\tfrac{1}{2} = \boxed{111\tfrac{1}{2}\text{in}}$$

e. 5 ft – 5 inches to decimal feet. Report to the nearest hundredth of a foot.

$$5\text{ft} + 5\text{in} \cdot \frac{\text{ft}}{12\text{in}} = 5 + 0.42 = \boxed{5.42\text{ft}}$$

f. 79.3 cm to inches.

$$79.3\text{cm} \cdot \frac{\text{in}}{2.54\text{cm}} = \boxed{31.22\text{in}}$$

21. The standard deviation of a data set is given by $\sigma = \sqrt{\frac{\sum (x-\mu)^2}{N}}$, where μ = the mean and N = the number of elements in the data set. Find the standard deviation of the data. You must **show your work** for credit. Use the chart to record your work. Round the final answer to the nearest hundredth. *(10 points*).

Data Set: **3.0, 2.9, 3.1, 3.9, 3.5, 3.2**

x	$x - \mu$	$(x - \mu)^2$
2.9	2.9 - 3.2667 = -0.3667	0.1345
3.0	3.0 - 3.2667 = -0.2667	0.0711
3.1	3.1 - 3.2667 = -0.1667	0.0278
3.2	3.2 - 3.2667 = -0.0667	0.0044
3.5	3.5 - 3.2667 = 0.2333	0.0544
3.9	3.9 - 3.2667 = 0.6333	0.4011
	SUM	**0.6933**

Standard Deviation of this data: **0.34**

Show your work here:

$$\mu = \frac{2.9+3.0+3.1+3.2+3.5+3.9}{6} = 3.2667$$

$$\sigma = \sqrt{\frac{\sum (x-\mu)^2}{N}}$$
$$= \sqrt{\frac{0.6933}{6}}$$
$$= \sqrt{0.1156}$$
$$= 0.34$$