Name: _____Answer Key_____ Date: _____
Honors Physics Test #1 Review

Measurement & Mathematics

In order to prepare for Test #1 I suggest you do the following:

1. Read chapter 1.

2. Terms to know: scientific notation, significant digits, fundamental units, derived units, metric units and prefixes, base unit, SI units, dimensional analysis (factor/label method), order of magnitude estimations, independent variable, dependent variable, control variable, hypothesis, range, mean/average, uncertainty in mean/average, percent error, accuracy, precision, graph relationships.

3. Be able to make order of magnitude estimations.

4. What are the seven fundamental units in the SI system? What are derived units? Give an example.
   Fundamental = building block units – cannot be broken down (see page 2 for list)
   Derived = combinations of two or more fundamental units
5. What is a base unit? Give an example. How does it differ from a fundamental unit?
   Base unit = unit without prefix = gram Fundamental – can have prefix = kilogram
6. Know how to put numbers into proper scientific notation. What is the addition/subtraction rule? What is the multiplication/division rule?

7. Know how to convert units within the metric system using metric prefixes. Be able to use the factor/label (dimensional analysis) method.

8. Be able to tell the number of significant digits in a number.

9. Know how to report the answers to calculations with the correct number of significant digits. What is the addition/subtraction rule? What is the multiplication/division rule?

10. Identify some reasons why a measurement is always uncertain.
    Cannot calibrate tools to infinitely smallest amount – human estimation when measuring
11. Be able to calculate the mean, range, and the uncertainty in the mean of a set of data.
    Range = high – low Average (Mean) = sum of values/# trials Uncertainty = range/# trials
12. How does a value become an "accepted" value?
    Repeated measurements over time or multiple trials averaged together.
13. Be able to pick out independent, dependent and control variables from an experiment.
    Independent = you control and set interval Dependent = what measuring
14. What is the difference between accuracy and precision? Give an example.
    Accuracy = close to correct value
    Precise = values close to each other
15. Be able to graph data and draw a best fit line or curve. Be able to calculate the slope of a line. Be able to write the general and specific equation of the line.

16. Know how to sketch the five most common types of relationships and give their general equations.

Solve the problems below using correct significant figures and scientific notation.

1. State the number of significant figures present in the following figures.

a) 8743 m	b) 0.045 K	c) 86,002 kg	d) 2000 s
4	**2**	**5**	**1**

e) 3600. N	f) 90.00 m	g) .00100 s	h) 50.050 J
4	**4**	**3**	**5**

2.
287.6 s
36.841 s
+ 1.43 s
325.871

Least # decimals

= 325.9 s

3.
27.61 mm
- .0077 m
27.61 mm
– 7.7 mm
19.91 mm

Convert units
Least # decimals

= 19.9 mm

4. 8.6342 s x 71.1 s = **613.892 s² = 614 s²**

Least # s.f.

5. (207.1 m) / (10 m) = **20.71 = 20**

Least # s.f.

6. 9.14×10^2 m + 8.6×10^4 m =

$.0914 \times 10^4$ m + 8.6×10^4 m

= 8.6914×10^4 m = 8.7×10^4 m

Same power of 10
Least # decimals

7. (7.30×10^2 m)(5.0×10^5 m) =

= 3.65×10^8 m² **= 3.7×10^8 m²**

Least # s.f.

8. (3.14×10^6 m) / (2.9×10^8 m) =

= 0.010828 =0.011 OR 1.1×10^{-2}

Least # s.f.

9. Using dimensional analysis convert 56 m/s into mi/hr.

$$\left(\frac{56m}{s}\right)\left(\frac{3600s}{1hr}\right)\left(\frac{1mi}{1609m}\right)=\frac{201600mi}{1609hr}=125\,\tfrac{mi}{hr}=130\,\tfrac{mi}{hr}$$

Because 56 only has 2 s.f., 125 must round up to match

10. How many meters are in a 67.2 gigameter?

$$\left(\frac{67.2Gm}{1}\right)\left(\frac{10^9 m}{1Gm}\right)=6.72\times10^{10}m$$

11. How many micrograms are in 1 kilogram?

$$\left(\frac{1kg}{1}\right)\left(\frac{10^3 g}{1kg}\right)\left(\frac{1\mu g}{10^{-6} g}\right)=1\times10^9\,\mu g$$

It is easier to go to the base unit first, then another prefix

12. Estimate the approximate height of a child in meters using magnitudes of 10.

10^0 m = 1 m

(versus 10^1 = 10 m or 10^{-1} = 10 centimeters)

13. Estimate the approximate weight of a couch in kilograms using magnitudes of 10.

10^2 kg = 100 kg

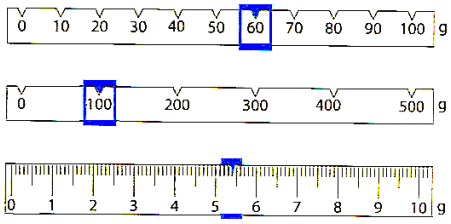
(versus 10^1 = 10 kg or 10^3 = 1,000 kg)

14.

a. Measure the diameter of the basketball in centimeters. Report the value in meters. Remember to include uncertainty.

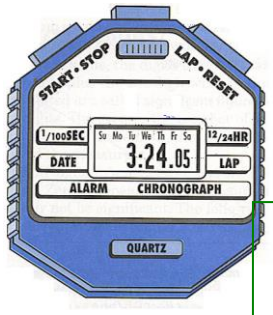
3.39 cm ± .02 cm
0.0339 m ± 0.0002 m

b. Measure the mass of the object in grams. Report the value in kilograms. Remember to include uncertainty.



165.40 g ± 0.02 g
0.16540 kg ± 0.00002 kg

c. What is the elapsed time in seconds? Remember to include uncertainty.



Round stopwatches to nearest 1/10

204.1 s ± 0.2 s
Remember to convert minutes to seconds

15. A student attempts to measure the length of a floor tile in physics class. The results of five trials are listed below.

Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
56.30 cm	57.10 cm	56.75 cm	56.42 cm	57.02 cm

a. Calculate the range of the data.

Range = High – Low = 57.10 cm – 56.30 cm = 0.80 cm

To get full credit on a, b, c, and e, you must show equation, substitute with units, and report your final answer with sig figs and units.

b. Calculate the mean (average) of the data.

$$avg = \frac{sum}{\#\,trials} = \frac{56.30cm + 57.10cm + 56.75cm + 56.42cm + 57.02m}{5} = \frac{283.59m}{5} = 56.72cm$$

c. Calculate the uncertainty in the mean.

$$\text{uncertainty} = \frac{range}{\#\,trials} = \frac{0.80cm}{5} = 0.16cm$$

d. As accurately as the student can determine based on this data, a floor tile's length is somewhere between what two values?

Between 56.88 cm and 56.56 cm

e. Your teacher reveals that the floor title's length is 56.78 cm, what is the percent error of the average value?

$$\%error = \frac{real - theoretical}{real} \times 100 = \frac{56.78cm - 56.72cm}{56.78cm} \times 100 = 0.1057\%$$

16. A student does a physics experiment in which she lets a toy car travel along the floor. At one minute intervals she records the distance in meters. Her data is summarized in the table below.

Time (min)	0	1	2	3	4	5
Distance (m)	0	1.1	2.2	3.0	4.2	5.1

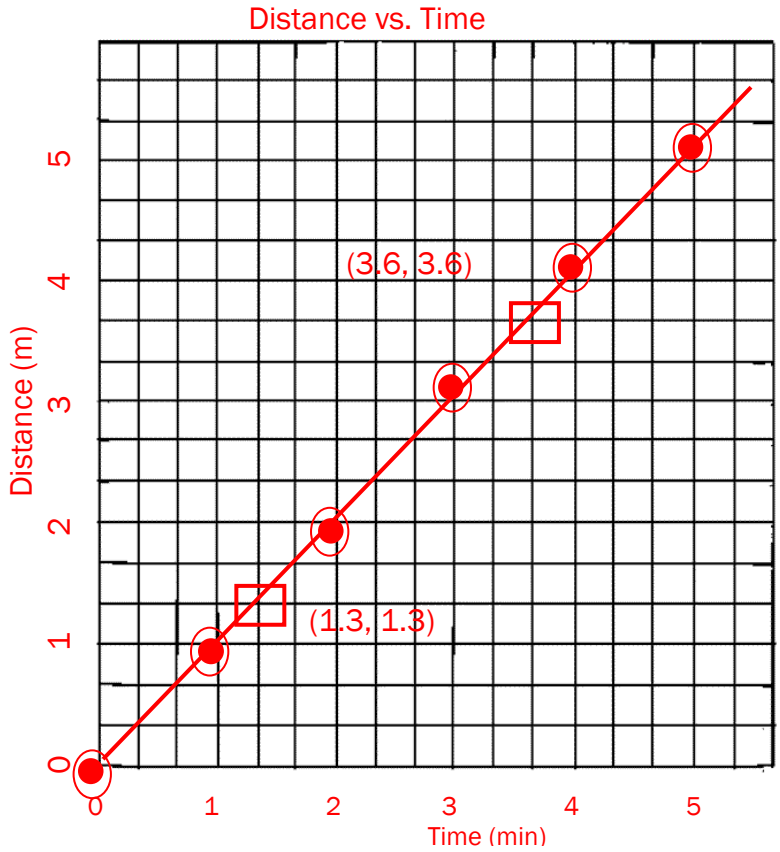
a. Which is the independent variable?

Time – because she set it at specific intervals

b. Which is the dependent variable?

Distance – what she is measuring – depends on time interval selected

c. Graph the data properly in the space below, including a best-fit line or curve.



d. Calculate the slope of the best-fit line. Show all calculations here, including formula and substitutions with units.

To get full credit you must show equation, substitute with units, and report your final answer with sig figs and units.

$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{3.6\text{m} - 1.3\text{m}}{3.6\text{min} - 1.3\text{min}} = 1.0\ \text{m/min}$$

e. According to your graph, what type of relationship is there between time and distance?

Direct

17. The mass of a high school football player is approximately

100 kg ≈ 200 lbs

(A) 10^0 kg (B) 10^1 kg (C) 10^3 kg (D) 10^2 kg

18. The height of a doorknob above the floor is approximately

1 m

(A) 1 x 10^0 m (B) 1 x 10^1 m (C) 1 x 10^{-2} m (D) 1 x 10^2 m

19. How many significant figures are there in the number 304500 meters?

(A) 3 (B) 4 (C) 5 (D) 6

Zero to right only count if decimal is present

20. Which one of the following is a fundamental unit?

Memorize!

(A) Ampere (B) Coulomb (C) Ohm (D) Volt

21. A student measures a distance several times. The readings lie between 49.8 cm and 50.2 cm. This measurement is best recorded as

(A) 50.0 cm ± 0.4 cm
(B) 49.8 cm ± 0.4 cm
(C) 50.0 cm ± 0.2 cm
(D) 49.8 cm ± 0.2 cm

22. The mass of an object is measured to be 18.65 kg and its volume 4.3 m^3. If the density (mass per unit volume) is calculated from these values, to how many significant figures should it be expressed?

(A) 1 (B) 2 (C) 3 (D) 4

4.3 only has 2 s.f., which is lowest

23. Convert to meters: 78 μm

(A) 7.8 x 10^{-7} m (B) 7.8 x 10^{-6} m (C) 7.8 x 10^{-5} m (D) 7.8 x 10^6 m

24. Convert to proper scientific notation: 902 x 10^{66}

(A) 9.02 x 10^{64} (B) 9.02 x 10^{66} (C) 9.02 x 10^{67} (D) 9.02 x 10^{68}

25. Which of the following is a base unit?

No prefix

(A) gram (B) kilogram (C) centimeter (D) nanosecond

26. Report the answer to the correct number of significant digits: 57.783 cm – 6.1 cm

Least # decimals

(A) 51..683 cm (B) 51.68 cm (C) 51.7 cm (D) 52 cm

27. Perform the following calculation and answer using the correct number of significant digits: 8.23 x 10^{-29} ÷ 5.2 x 10^{-13}

(A) 1.5 x 10^{-16} (B) 1.6 x 10^{-16} (C) 1.58 x 10^{-16} (D) 2 x 10^{-16}

Least # s.f.

28. Of the following, the smallest quantity is

(A) 0.635 km (B) 0.635 x 10^4 cm (C) 6.35 x 10^4 m (D) 0.635 x 10^6 mm (E) 0.635 x 10^5 m

29. Fifty five millimeters is approximately equivalent to

(A) 0.055 m (B) 55 m (C) 0.55 m (D) 5.5 m (E) 0.0055m

30. Of the following, the largest quantity is

(A) 0.047 cm (B) 47 x 10^{-4} cm (C) 4.7 x 10^{-2} cm (D) 0.00047 x 10^2 cm (E) 0.000047 x 10^4 cm

31. The number 300,000,000 can be written as

(A) 3×10^6 (B) 3×10^7 (C) 3×10^8 (D) 3×10^9 (E) 3×10^{-9}

32. A millimeter is

(A) 10^3 m (B) 10^2 m (C) 10^1 m (D) 10^{-3} m (E) 10^{-6} m

33. Which of the following represents the same quantity as 6.50×10^{-3} ampere?

I. 6.50 mA
II. 65.0×10^{-4} A
III. 0.00650 A
IV. 65.0×10^{-2} A

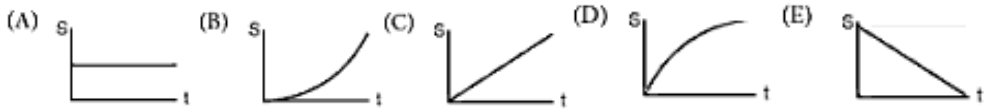
(A) I, II, and III only (B) I and III only (C) II and IV only (D) IV only (E) none of them

34. Which of the following represents a derived unit?

I. Newton
II. Kilogram
III. Ampere
IV. Pascal

(A) I, III, and IV only (B) I and IV only (C) I only (D) all of them (E) none of them

Questions 35 through 37 are based upon the following graphs.



35. Which of the graphs represents a direct relationship?

(A) A (B) B (C) C (D) D (E) E

36. Which of the graphs represents a quadratic relationship?

(A) A (B) B (C) C (D) D (E) E

37. In which graph is the slope a negative value?

(A) A (B) B (C) C (D) D (E) E

Answers:
1.
a. 4
b. 2
c. 5
d. 1
e. 4
f. 4
g. 3
h. 5
2. 325.9 s
3. 19.9 mm
4. 614 s^2
5. 20
6. 8.7×10^4 m
7. 3.7×10^8 m^2
8. 1.1×10^{-2}
9. 130 mi / hr
10. 6.72×10^{10} m
11. 1×10^9 µm
12. 10^0 m
13. 10^2 kg
14.
a. 0.0339 m ± 0.0002 m
b. 0.16540 kg ± 0.00002 kg
c. 204.1s ± .2s
15.
a. 0.80 cm
b. 56.72 cm
c. 0.16 cm
d. 56.88 cm – 56.56 cm
e. 0.1057 %
16.
a. Time
b. Distance
c. See sheet in class
d. 1.0 m/min
e. Direct
17. D
18. A
19. B
20. A
21. C
22. B
23. C
24. D
25. A
26. C
27. B
28. B
29. A
30. E
31. C
32. D
33. A
34. B
35. C
36. B
37. E