Physical Science   Name _____KEY_____

■ ■

1. The first experiment compares ___mass___ to ___force___.

2. Based on Figure 1, how much force is required to pull a 2.00 kg block?___10N___

3. What is the unit used for force?___N___

4. For each 1 kg increase in mass of the block, what is the increase in force?___5N___

5. What force is required to pull 2.00 kg?___10 N___

6. What mass is pulled by a force of 20 N?___4 kg___

7. The graph has 3 known data points graphed: a mass of 1.00 kg, 2.00kg, and 4.00 kg. But the graph can also be used to find the force on other masses. *Interpolation* is the process of reading a graph between two *known* data points. What is the pulling force required for a mass of 1.50 kg?___7.5N___ What is the pulling force required for a mass of 3.25 kg?___16.25___
(between 7+8)   (about 16)

8. *Extrapolation* is the process of reading a graph *beyond* the known data. For instance, what would be the pulling force required for a mass of 4.50 kg?___22.5 (about 22 or 23)___

9. Figure 1 shown different masses being pulled with different forces. But Figure 2 shows different masses being pulled with ___the same force (30N)___

10. In figure 2, what force is used to pull the 2.50 kg block? 30N

11. In figure 2, what is the speed of the 2.00 kg block after it has been pulled for 3.00 seconds? 30 m/s

12. In figure 2, what is the speed of the 3.00 kg block after it has been pulled for 1 second? 5 m/s

13. In figure 2, how long does it take each block to reach a speed of 20.00 m/s?

    a. The 2 kg block   2.00 sec

    b. The 2.5 kg block   about 2.7

    c. The 3 kg block   it never reached 20 m/s

14. Make a conjecture about the speed of a 3.00 kg block after it has been pulled for 4 seconds.
Speed = _20_ m/s

15. Make a conjecture about the speed of a 2.50 kg block after it has been pulled for 4 seconds.
Speed = _27_ m/s
about

16. In the previous 2 questions, what does the word "conjecture" mean? a prediction based on data

17. In questions 14 & 15, did you need to interpolate or extrapolate? _extrapolate_ Explain your answer. You had to extend beyond known data

18. For Figure 1, let *m* = block mass and let *F* = pulling force. Write an equation that shows the relationship between *F* and *m*.

$$F = 5m$$

For Figure 2, each block shows a changing speed. The term for a change in speed is *acceleration*. The formula for acceleration is $acceleration = \frac{s_2 - s_1}{t_2 - t_1}$

19. For the 2.00 kg block: let t_1 = 1.00 sec, s_1 = _$10 \, m/s$_ ; let t_2 = 2.00 sec, s_2 = _$20 \, m/s$_ .

20. Use the data in the previous question to calculate the acceleration of the 2.00 kg block. Use the formula for acceleration.

$$acc = \frac{20 \, m/s - 10 \, m/s}{2s - 1s} = \frac{10 \, m/s}{1s} = \boxed{10 \, m/s^2}$$

21. For the 2.50 kg block: let t_1 = 2.00 sec, s_1 = _$14 \, m/s$_ ; let t_2 = 3.00 sec, s_2 = _$22 \, m/s$_

22. Use the data in the previous question to calculate the acceleration of the 2.50 kg block. Use the formula for acceleration.

$$acc = \frac{22 \, m/s - 14 \, m/s}{3s - 2s} = \frac{8 \, m/s}{1s} = 8 \, m/s^2$$

23. Do the blocks of different mass appear to have the same acceleration? _NO_ Why do you think this is so?

1) The slopes are different, not changing by the same amount.

2) Also #20 + 22 have different accelerations.

Physical Science

ACT Preparation- Wet Deposition

■ I

1. How do Cu^{2+} and Zn^{2+} get into the atmosphere? *high temperature Combustion*

2. What is the meaning of the meaning of the word *respectively* at the end of the first paragraph?
   Cl^- is road-salt dust, SO_4^{2-} is electrical power

3. What does table 1 show? *Precipitation per month*

4. How was the data in table 1 collected? *a rain gauge on a roof*

5. According to Figure 2, how many micrograms of Cu^{2+} were collected July? *about 40*

6. According to Figure 2, which month had the most Zn^{2+} collected? *January*

7. Compare and contrast Figure 2 and Figure 3. *many similarities. Very different # on vertical axis. different units*

8. In Study 3, how many different collect sites were used to collect data? *3*

9. The vertical axis on Figure 4 has a break in the vertical line at the 1000 mark. What does that break mean? (Hint: look at the numbers on the axis.) *The numbering below is every 200, above is every 1000.*

10. Question #8 asks for an average. Normally an average is found by adding up several numbers and dividing by the total. But that is not necessary in this case. How else can you find the average? *Just look at the plots the graph. Notice that most of them fall in a certain range. Look at the choices. Choose the one that makes sense.*

11. According to Study 3, what happens to the amount of wet deposition as you move closer to the city? *it increases*

12. Compare the amount of precipitation (Figure 1) and the amount of ions collected (Figures 2 & 3). Do the data show that an increase in precipitation also means an increase in wet deposition? Explain why or why not. *No. Jan + Feb showed the most rain (figure 1) but Fig 2+3 do not show highest amount of ions in January + February.*

Mark each as a variable or a control in Study 1. Use V for variable and C for control.

13. ___C___ location

14. ___V___ amount of precipitation

15. ___V___ amount of deposition

Name ___*KEY*___

ACT Preparation- Cloud Cover

■ ■

1. According to Table 1, does an increase in cosmic rays correspond to an increase or decrease in cloud cover?

   inc. cosmic rays → inc. cloud cover

2. Figures 1-3 all the same labels on horizontal and vertical axes. But there is a significant difference between the 3 figures. What is the difference? *The cloud height (read axis on left)*

3. Consider Figure 1. If you want to know the monthly average cloud cover, which line should you look at? *broken line - - -* Which vertical axis would you look at, the one on the left or the right of the graph? *left*

4. RCRF does not measure the total amount of cosmic rays. What does it measure?

   Relative cosmic ray flux, compared to October 1, 1965

5. What do you think is the significance of October 1, 1965? *There was a powerful solar flare*

6. Which figure supports the statement "An increase in RCRF corresponds to an increase in cloud cover." *Figure 3* Explain your answer. *The peaks are together; as one increases the other increases.*

7. What new information is introduced in question #17?

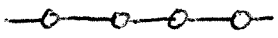   *high clouds primarily ice, low clouds primarily water.*

ACT Preparation- Fruit Flies

■ I

Fruit Flies Experiment

Study 1

1. What does *SY* stand for? *Sugar yeast*

2. Identify the contents of each test tube :

    a. Tube 1 *15% SY medium*

    b. Tube 2 *15% SY and yeast odors*

    c. Tube 3 *15% SY and live yeast*

3. Which test tube was the control? *1* How do you know? *Nothing else was added to it.*

4. What were the variables in Study 1? *yeast odor & live yeast*

5. Why were virgin fruit flies used in this experiment? What could be the consequences of using fruit flies that had mated? *No baby fruit flies would hatch. That would mess up the count.*

6. Study the key for Study 1. Draw the symbol used to each tube:

    a. Tube 1 —o—o—o—o—

    b. Tube 2 —▢—▢—▢—

    c. Tube 3 —▲—▲—▲—▲—

7. How many fruit flies where present in each test tube at the beginning of Study 1? *200*

8. What percent of the fruit flies were alive in tube 3 after 35 days? *35%* How many of original 200 were alive after 35 days? *70*   *35% of 200 = 70*

9. Which medium has the most detrimental effect on the life span of fruit flies? *Tube 3, 15% + live yeast*

10. Were the fruit flies in Study 1 able to detect odors? *NO* How do you know? *No difference between results in tube1 + tube 2.*

Study 2

11. How is Study 2 similar to Study 1? 3 tube, different in each, 200 flies, 5 days

12. How is Study 2 different from Study 1? Different base medium + different variables

13. Which medium had the most detrimental effect on the life span of fruit flies? 5% SY + live yeast tube B,

14. Which medium seemed to have the most beneficial effect on the life span of fruit flies? tube 4, 5% SY

15. Compare Study 1 & Study 2 for the results of SY medium and additional odors. What percent of fruit flies are alive after 40 days for 15% SY with additional odors? 30% What percent of fruit flies are alive after 40 days for 5% SY with additional odors? 80%. Make a prediction concerning the percent of fruit alive after 40 days if a test were conducted for a 10% SY medium. 55%

$$\frac{80+30}{2} = \frac{110}{2}$$

Since 10% is halfway between 5% + 15%, average it.

Study 3

16. How are the fruit flies in Study 3 different from the fruit flies used in Study 1 and Study 2? Can't detect odors

17. Compare the life span of Strain N to Strain X. Which strain seems to live longer? X

18. Does the sense of smell seem to be harmful or detrimental to the life span of a fruit fly? harmful Explain your answer. N can smell, shorter life span.

19. Suppose an additional trial were to be done with 12% SY medium. What would be the average life span of the strain N fruit flies? between 44.7 + 46.1 about 45.5

Compare the studies:

Answer the multiple choice questions on page 41.

ACT Preparation- Greenhouse Gases

■ |

1. Give an example of a greenhouse gas. _methane CH4_

2. What does the author of the research say that greenhouse gases do to the Earth's climate? _warm it up_

3. Study the Key for figure 1. This graph shows both ___Solar radiation___ and ___CH4___ for _250_ thousand years.

4. What quantities are shown on the vertical axis on the left of the graph? _Solar radiation intensity_

5. What quantities are shown on the vertical axis on the right of the graph? _Concentration of CH4 in atmosphere_

6. What does "ppb" stand for? The number of ___parts___ _(molecules)_ of CH_4 per ___billion___ of parts of the atmosphere.

7. What was the concentration of solar radiation 150,000 years ago? _500 Watts/m²_ (Include a number and a unit)

8. What was the concentration of methane gas 150,000 years ago? _580 ppb_ (Include a number and a unit)

9. About 160 thousand years ago, the lines for solar radiation and CH_4 concentration seem to overlap. Does this mean that they had equal concentrations? _NO_ Explain your answer. _The scales on the left vertical & right vertical do not match._

10. According to figure 1, do solar radiation and methane concentration seem to be directly or inversely proportional? _directly_ Explain your answer. _When solar radiation increases, methane increases. When one decreases, the other decreases._

11. If the concentration of CH4 is related to the temperature of Earth, can you conclude that the temperature of Earth for the past 250 thousand years has been steady or fluctuating? _fluctuating_ Explain your answer. _CH4 goes up + down, so Earth must go up + down._

12. How is the time period for Figure 2 different from (Figure 1?) _much more recent._

13. According to figure 2, what seemed to start happening about 5,000 years ago? *CH₄ began to increase*

14. If the correlation between CH₄ and Earth's temperature is true, what can you conclude about the Earth temperature for the past 5 thousand years? *temperature increased*

15. You have learned in science class, and from your own personal observations, that the energy from the sun warms the earth. But what is the assumption that is made about the temperature of the earth in this passage? *It is also related to CH₄. (In the last 5000 years solar radiation decreased.)*

16. Do either of these graphs show the temperature of the earth? *NO, radiation ≠ temp.*

17. What hypothesis is supposedly supported by the data in figure 2?
"human activities may have begun warming Earth climate thousands of years earlier than once thought."

18. You have learned that science should be testable and repeatable. Is the data in this passage testable or repeatable? Explain your answer.

Physical Science　　　　　　　　　　Name ___*KEY*___

ACT Preparation- Monarch Butterflies

■ ﹍

Introduction Paragraph. Read the paragraph and then answer the following questions.

1.　Monarch butterflies migrate from ___*North Am.*___ to ___*Mexico*___ during what time of
　　the year? *Fall*

2.　What habitat to the butterflies choose for the overwinter period? *high altitude forest,*
　　(oyamel fir)
　　evergreen conifer trees

3.　Where do butterflies get energy?
　　　body lipids

4.　**Read the next three paragraphs: Hypothesis 1, Hypothesis 2, and Hypothesis 3. Complete the**
　　chart with information about the _storing_ of lipids, the _use_ of lipids, and the _lipid_ mass. There
　　may not be information for each box.

	Before migration	During migration	After migration, before beginning overwinter	During overwinter
Hypothesis 1	Store lipids Lipids increase	Convert lipids to energy Lipids decrease	Store lipids Lipids Increase	Convert lipids to energy Lipids Decrease
Hypothesis 2	store lipids Lipids increase	Convert lipids to energy lipids decrease	not store lipids	not require lipids
Hypothesis 3	not store lipids	store lipids Lipids increase	do not store	Use lipids for energy lipids decrease

5.　Answer the multiple choice questions on p. 42-43.

ACT Preparation: Drilling Mud

■ ▪ ▪

Read the paragraphs before the graphs.

1. The three plots of land were carefully chosen. They were all unsloped. Why is that important in this study? *b/c DM is a liquid, it would run off if the land were sloped*

2. The three plots of land were carefully chosen. They were all had the same amount of vegetation. Why is that important in this study? *Vegetation can affect how much DM hits the ground, it is a control—not a variable*

3. Was the area of the plot a variable in this experiment?__*NO*__ Explain your answer. *all same area 10m by 40m*

4. Why is DM sprayed onto the land and vegetation? *to dispose of it after it is used for drilling. to test if it affects soil temperature, albedo*

5. There were 2 sensors for each plot of land. What did the 2 sensors measure? *soil temp & solar radiation (albedo)*

6. If an area of land is absorbing sunlight, what would be true about the temperature of the land? *it will increase*

7. What is albedo? *the light that is reflected from a surface*

8. What was the albedo for plot 2 on July 15? *0.16*

9. For plot 1 on August 9, what percent of incoming solar radiation was *not* reflected from the surface? *100 - 24 = 76%*

10. On July 5, what was the temperature of plot 3? *about 22.5*

11. Which plot consistently demonstrated a higher temperature? *Plot 3*

12. Which plot consistently demonstrated a higher albedo? *Plot 1*

13. What was the overall effect of DM on aldedo? *(Plot 3 had most DM, lowest albedo) (Plot 1 had NO DM, highest albedo)* *DM LOWERS ALBEDO*

14. What was the overall effect of DM on the temperature of the land?

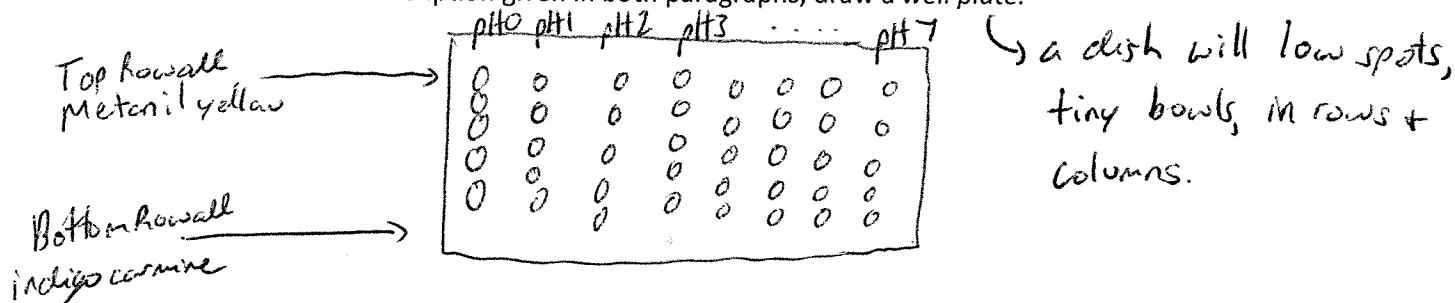*DM increases temperature.* *(Plot 3 most DM, highest temp. Plot 1 NO DM, lowest temp)*

Physical Science

Name **KEY**

ACT Preparation: Acid-Base Indicator

■ |

Read the introductory paragraphs and then answer the following questions:

1. What makes an acid-base indicator change color? *the pH of the substance*

2. What is a transition range? *an intermediate color, between low pH + high PH*

Experiment 1. Read the experiment and study the table.

3. Based on the description given in both paragraphs, draw a *well plate*.

Top Rowall Metanil yellow →

pH0 pH1 pH2 pH3 . . . . pH 7

↳ *a dish will low spots, tiny bowls in rows + columns.*

Bottom Rowall indigo carmine →

4. Based on Table 1, what color does metanil yellow turn in a solution of pH 2? *Red*

5. Based on Table 1, for what pH values is resorcin blue not actually blue? *pH0 — pH6*

6. If you wanted to know if a solution had a pH of 1 or 2, which indicator would you use? *Metanil yellow. To distinguish 1 or 2 it must have different colors from other indicators.*

7. Why is indigo carmine the same color in each well? *It doesn't react for low PH, must change color for higher pH.*

Experiment 2. Read the experiment and study the table.

8. If you wanted to know if a solution had a pH of 8 *and 9*, which indicator would you use? *Curcumin*

9. Indigo carmine turns from blue to yellow. What is the intermediate color for indigo carmine? *green* and at what pH does this color occur? *12*

10. Curcumin changes from ___*Yellow*___ to ___*Red*___. At what pH values is this change visible? *8*

Experiment 3. Read the experiment and study the table.

11. What is the pH of mystery solution IV? ___*2*___ Which pH indicator was the most helpful in determining the pH of solution IV? *Metanil yellow*

12. Which solution has the highest pH? __II__ Which pH indicator was the most helpful in determining the highest pH? _Indigo carmine turned yellow_

13. A student claimed that solution I had a pH of 7. Do the results of these experiments support his claim? __NO__. Explain your answer. _Curcumin is not red in pH 7. Curcumin should be yellow if 7 were true._

14. Write an inequality for the indicator colors:

Example: metanil yellow is red for pH ≤ 1 and is yellow for pH ≥ 3

a. Resorcin blue is red for pH __≤ 3__ and is blue for pH __≥ 7__

b. Curcumin is red for pH __≥ 9__, yellow for pH __≤ 7__, and is orange for pH __= 8__.

c. Indigo Carmine: __blue for pH ≤ 11, yellow for pH ≥ 13; green for pH = 12__

Physical Science Name __KEY__

■ I

**Read the introductory paragraph.** *Then answer the questions according to the introductory* *paragraph:*

1. Island A contains which bird(s)? Both G. fortis + G. fuliginosa

2. Island B contains which bird(s)? G. fortis

3. Island C contains which bird(s)? G. fuliginosa

4. What do birds with shallow beaks eat? small seeds

5. What do birds with deeper beaks eat? both large + small (prefer small)

Study 1. _Read the paragraph_ *for and observe the graph for Study 1.*

6. How many graphs correspond to Study 1? 3

7. What is measured on the horizontal axis of each graph? beak depth

8. What is measured on the vertical axis of each graph? % of captured finches

9. The first graph has a column for G. fuliginosa that reaches almost 50%. This column represent a range of beak depths from __7.75__ to __8.25__ mm.

10. On Island A, what is the smallest beak size for G. fuliginosa? 8.75 - 9.25 mm

11. Why would the researchers tag the birds they captured in study 1? To avoid counting them twice. If it has been tagged, it will not be counted.

12. In a situation in which the 2 species of bird are in competition for food, which bird is likely to have a larger beak size? __G fuliginosa__. Which graph supplied the answer? __first one shows both species in competition__

Study 2. _Read the paragraph_ *and observe the graph for Study 2.*

13. From the introduction paragraph and Study 2 the following things are related: deeper beaks, __larger (average)__ seeds, dry years. What year shows the connection between these 3 things? __1977, 1980, 1982__

14. From the introduction paragraph and Study 2, the following things are related: shallow beaks, __small__ seeds, wet years. What year shows the connection between these 3 things? __1984__

15. In 1984, would a bird with a beak depth of 9.2mm or 9.5 mm be more likely to survive? __9.2__ Explain you answer. Smaller average for wet year