

B - Experiment & Data Analysis - Nov 7 Country-wide SO Practice - 11-07-2020

Welcome to Experiment and Data Analysis Test!!

As Ms. Frizzle from The Magic School Bus says "Take chances, make mistakes, and get messy!"

You are allowed to bring in a pencil, paper, calculator and of course your brain!! :-)

This event will work in 2 parts.

The first part is similar to the old rules of the first part of experimental design. You will be given the materials list with images and you will only design the experiment. The second part is a test where you will be tested on data analysis as well as experimental design procedures and best practices.

Both parts will be given at the start and turned in together at the end of 50 minutes.

Good luck!!



Part 1: Experimental Design

Ms. Frizzle is back in action as her student Dorothy Ann is working on a science project. Dorothy Ann is doing an experiment on one of the Sir Issac Newton's law "Second law of Motion" Ms. Frizzle and her class are on the school bus to learn about the second law. Meanwhile help Dorothy Ann with Part I of the Experiment and Data Analysis.

Topic Area: Second Law of Motion

The Second law of motion states that relationship between net force, mass and acceleration. Specifically, Newton formulated that $F_{net} = m \times a$.

Materials:

- 2 cups
- 6 Popsicle sticks
- 2 straws
- 4 rubber bands
- 4 paper clips
- 6 index cards
- 4 blocks: gray, blue, purple, orange
- 2 marbles
- 1 golf ball
- 1 plastic ball
- Masking tape
- String
- Scissors
- Digital scale
- Foam-core Boards
- Matchbox cars

Good Luck team!! "Where the road ends, adventure begins!" Ms Frizzle

1. (2.00 pts) A. Statement of Problem

Expected Answer:

2. (6.00 pts) B. Hypothesis

Expected Answer:

3. (6.00 pts) C. Independent Variable

Expected Answer:

4. (4.00 pts) C. Dependent Variable

Expected Answer:

5. (4.00 pts) C. Controlled Variables

Expected Answer:

6. (2.00 pts) C. Constant

Expected Answer:

7. (14.00 pts) E. Procedure and Set-up Diagrams

Expected Answer:

8. (4.00 pts) D. Materials

Expected Answer:

PART 2: Data Analysis

Ralphie from The Magic School Bus is preparing for a competitive swim competition and he records time taken for a lap using different swim style.

Backstroke	35s	44s	66s	50s	70s
Freestyle	20s	15s	37s	40s	17s
Breaststroke	35s	44s	66s	50s	120s
Butterfly	120s	112s	90s	200s	138s

9. (2.00 pts) Calculate the mean for freestyle.

Expected Answer: 25.8

10. (2.00 pts) Calculate the median for butterfly.

Expected Answer: 120s

11. (2.00 pts) Calculate the median for backstroke.

Expected Answer: 50s

12. (2.00 pts) Calculate the mode for backstroke.

Expected Answer: No mode

13. (6.00 pts) Calculate the standard deviation of the lowest swim style mean.

Expected Answer: Sample Standard deviation 11.77 or population standard deviation 10.53

14. (2.00 pts) Does an outlier exist in the backstroke style? Explain

Expected Answer: No outlier.

Two CNC machines that manufactures drill bits that are on average 10 inch long. A sample of 11 drill bits are selected from each machine and following are the length of the drill bits from each machines,

Machine A	6	8	8	10	10	10	10	10	12	12	14
Machine B	6	6	6	8	8	10	12	12	14	14	14

15. (2.00 pts) Mean of machine A

Expected Answer: 10

16. (2.00 pts) Mean of machine B

Expected Answer: 10

17. (2.00 pts) Range of Machine A

Expected Answer: 8

18. (2.00 pts) Range of Machine B

Expected Answer: 8

19. (2.00 pts) Sample variance of Machine A

Expected Answer: 4.8

20. (2.00 pts) Sample variance of Machine B

Expected Answer: 11.2

21. (2.00 pts) Which machine would be much preferred based on the variance?

Expected Answer: Machine A would be preferred over Machine B because it has smaller variance of 4.8 and produces drill bits closer to average length.

22. (2.00 pts)

Tim from Magic School Bus is working on this problem. What should Tim answer be?

The table given below shows the number of students who were absent and percentage of students who were present in the given two examinations from five different schools. The table also shows the percentage of students who were present in the Science and English examination respectively.

School	Absentees	Present in percentage(%)	Science in percentage(%)	English in percentage(%)
School 1	83,300	65	32	68
School 2	101,520	60	29	71
School 3	113,520	40	30	70
School 4	60,830	65	42	58
School 5	24,003	55	25	75

What is the average of the number of the students who were present in English examination from School 1, School 2 and School 4?

- A) 109635
- B) 84632
- C) 74365
- D) No answer

23. (4.00 pts)

Wanda is a real estate agent. She is able to close the house sales for 70% of her clients that are selling their houses. What would be the mean number of sales for her next 10 clients? What would be the standard deviation of this distribution?

- A) mean = 7 and standard deviation = 1.45
- B) mean = 7 and standard deviation = 1.33
- C) mean = 7 and standard deviation = 2.5
- D) mean = 10 and standard deviation = 1.45
- E) mean = 10 and standard deviation = 2.5

24. (2.00 pts)

Nikolaa automobile company discovered that approximately 4% of Model Nii cars made in 2017 have a defective component. Two samples of 150 cars(Sample A) and 250 cars (Sample B) were taken for the defective component. Which of the following statements must be true

- A) mean of Sample A < mean of Sample B
- B) mean of Sample A > mean of Sample B
- C) standard deviation of Sample A = standard deviation of Sample B
- D) standard deviation of Sample A > standard deviation of Sample B
- E) standard deviation of Sample A < standard deviation of Sample B

You are a data scientist and you have been given a task to measure the approval of the modes of learning for California state.
Distance learning, hybrid, in-person learning:

You are considering many ways to collect sample data and proposed the following methods. Name at least two thing wrong with each method.

25. (2.00 pts)

You plan to visit the playground during weekends near your place and ask every other person which learning modes they would approve. You are there morning at 9am till noon and try to collect 100 responses.

Expected Answer: Local population, limited hours and missing population who comes in the evening.

26. (2.00 pts) You plan to work with the local school district and send an online survey to randomly selected 100 residents

Expected Answer: The residents may choose to not respond, residents may not provide valid response as its sent by non school district official.

27. (2.00 pts)

You plan to run a poll on social media asking whether they approve distance learning, hybrid learning, in-person learning and none of the above. Close the poll when it hits 100,000

Expected Answer: The response could come from non parent population, people can vote more than once

28. (2.00 pts)

Mike is working in an online news agency and he has been assigned to increase the click rate. There are 2 million subscribers and around 48% are women and 52% are men. Around 15% of the women and 35% men click on the ads. If a random sample of 1000 subscribers are selected then what is the expected number of subscribers in the sample who click on ads?

Expected Answer: 254

Error:

29. (4.00 pts)

Jyothi from the Magic School Bus was conducting her chem lab experiment and she had to weigh different chemicals and forgot to tear the container used for putting the chemicals while using the digital scale.

Is it systemic or random error? Why?

Expected Answer: It is a systemic error and it had same effect on all measurement in the experiment.

30. (1.00 pts) Carlos from The Magic School Bus is looking at correlation problem. Help him in answering this this question. Which is an example of NO correlation?

(Mark **ALL** correct answers)

- A) The age of the child and their shoe size
- B) The age of the child and the amount of pets owned
- C) The age of the child and their height
- D) The age of the child and the amount of vocabulary words learned

31. (1.00 pts) Which of the following statement should Carlos select that shows a causal relationship and not just correlated one?

- A) A decrease in temperature and the increase in attendance at an ice skating rink.
- B) An individual's decision to work in construction company and his diagnosis of skin cancer.
- C) As a child's height increases so does her/his vocabulary.
- D) The number of minutes spent exercising and the amount of calories burned.

Precision, Accuracy, and Uncertainty

32. (2.00 pts)

Arnold is working in a factory which packs 5lbs of apples. During the quality inspection he randomly picked 5 bags and measured them. The following are the measurements:

5.105lb	5.110lb	5.115lb	5.120lb	5.125lb
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Are these precise or accurate in measurement? Explain

Expected Answer:

33. (1.00 pts) Is **one** measurement enough for precision?

True False

34. (1.00 pts) Can the following be determined by exact measurement or with some degree of uncertainty?

The mass of a dozen eggs

(Mark **ALL** correct answers)

- A) exact measurement
 B) some degree of uncertainty

35. (1.00 pts) Estimation of the amount differs from true value. Describes?

(Mark **ALL** correct answers)

- A) Accuracy
 B) Precisiion
 C) Uncertainty

36. (1.00 pts)

Wanda from The Magic School is working on chemistry experiment. She weighed the mass of a sample using same digital scale and obtained following values: 5.224 g, 5.235 g, and 5.25 g

Are these measurements

(Mark **ALL** correct answers)

- A) good precision
 B) good accuracy
 C) poor precision
 D) poor accuracy

37. (1.00 pts) _____ is the term used for the measurement of average kinetic energy particles of a substance.

Temperature

38. (1.00 pts) The Law of large numbers shows a relationship between the theoretical probability and exponential probability.

True False

Graphs:

39. (2.00 pts) Provide at least 2 types of graphs that could be used to compare values

Expected Answer: Column, Mekko, Bar, Pie, Line, Scatter Plot, Bullet

40. (2.00 pts) Provide at least 2 types of graphs that could be used to show composition

Expected Answer: Pie, Stacked Bar, Stacked Column, Area

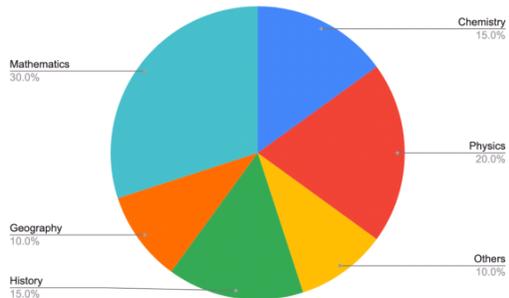
41. (2.00 pts) Provide at least 2 types of graphs that could be used to to analyze trends

Expected Answer: Line, Dual-Axis Line, Column

42. (2.00 pts) Provide at least 2 types of graphs that could be used to understand the distribution

Expected Answer: Scatter Plot, Line, Column, Bar

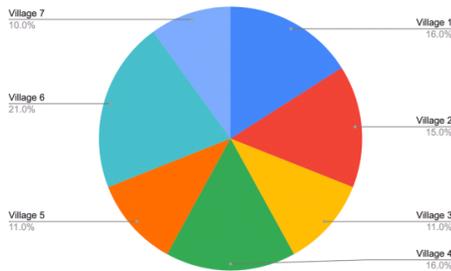
43. (2.00 pts) A pie-chart showing the hours spent studying for each subject by a student.



If the student spent 4 hours 30 mins studying both history and chemistry then how much he spent time studying in physics?

- A) 1.5 hours
- B) 2.9 hours
- C) 2 hours
- D) 3 hours

44. (2.00 pts) A pie chart about the proportion of population of seven villages in 2000.



Village	Population Below Poverty line in percentage (%)
Village 1	38
Village 2	52
Village 3	42
Village 4	51
Village 5	49
Village 6	46
Village 7	58

The ratio of the below poverty line population of 'Village 6' to that of the below poverty line population of 'Village 3' is

- A) 11:23
- B) 13:11
- C) 23:11
- D) 11:13

Claim Evidence Reason:

45. (8.00 pts) Keesha from the Magical School bus is examining the following data table:

	Density	Color	Mass	Melting Point
Liquid 1	0.63 g/cm ³	no color	38 g	-59 °C
Liquid 2	0.88 g/cm ³	no color	38 g	24 °C
Liquid 3	0.63 g/cm ³	no color	16 g	-59 °C
Liquid 4	18.5 g/cm ³	silver	18 g	-35 °C

Write a CER (Claim, Evidence, Reasoning) for this question.
Question : Are any of the liquids in the data table the same substance?

Expected Answer: Claim: Liquid 1 and liquid 3 are the same substance. Evidence: Have same melting point Have same density Both colorless Reasoning: Liquid 1 and liquid 3 are the same substance. In order for two liquids to be the same substances, they must have the same properties. Liquid 1 and liquid 3 both have the same densities, melting points and color. Therefore, liquid 1 and liquid 3 are the same substance.

46. (2.00 pts)

Dorothy Ann from the Magic School Bus is reading an article for an assignment.

"Scientists began recording average surface temperatures on Earth in 1880. 2018 was the fourth warmest year ever recorded since that time. The planet is warming over the long term, scientists announced Friday. The Earth's average temperature has risen 2 degrees Fahrenheit since 1880."

What should Dorothy Ann deduce from the introduction of the article of author's main claim?

- A) Scientists began recording average surface temperature on Earth in 1880.
- B) The planet is warming over the long term, scientists announced Friday.
- C) The Earth's average temperature has risen 2 degrees Fahrenheit since 1880.
- D) 2018 was fourth warmest year ever recorded since that time

Congratulations Team!!

"As I always say class, you're out of this world." Ms. Frizzle

