

**TMSCA MIDDLE SCHOOL
SCIENCE
TEST #7 ©
JANUARY 14, 2023**

GENERAL DIRECTIONS

1. About this test:
 - A. You will be given 40 minutes to take this test.
 - B. There are 50 problems on this test.
2. All answers must be written on the answer sheet/Scantron form/Chatsworth card provided. If you are using an answer sheet be sure to use **BLOCK CAPITAL LETTERS**. Clean erasures are necessary for accurate grading.
3. If using a Scantron answer form, be sure to correctly denote the number of problems not attempted.
4. You may write anywhere on the test itself. You must write only answers on the answer sheet.
5. You may use additional scratch paper provided by the contest director.
6. All problems have **ONE** and **ONLY ONE** correct [BEST] answer. There is a penalty for all incorrect answers.
7. On the back of this page is a copy of the periodic table of the elements as well as a list of some potentially useful information in answering the questions.
8. A simple scientific calculator with the following keys is sufficient for the science contest: +, -, %, ^, log x, e^x, ln x, y^x, sin x, sin^{-x}, cos x, cos^{-x}, tan x, tan^{-x}, with scientific notation and degree/radian capability. The calculator must be silent, hand-held and battery operated. The calculator cannot be a computer or cannot have built-in or stored functionality that provides scientific information and cannot have communication capability. If the calculator has memory, it must be cleared. Each student may bring one spare calculator. **NO GRAPHING CALCULATORS ARE PERMITTED.**
9. All answers within $\pm 5\%$ will be considered correct.
10. All problems answered correctly are worth **FIVE** points. **TWO** points will be deducted for all problems answered incorrectly. No points will be added or subtracted for problems not answered.
11. In case of ties, percent accuracy will be used as a tie breaker.

Periodic Table of the Elements

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------|--------------------|-------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|-------------------|-------------------|---------|---------|---------|---------|---------|---------|---------|-----------|-----------------|-----------------|-------------------|-------------------|------------------|-------------------|-------------------|-------------------|
| 1A 1 | | | | | | | | | | | | | | | | | 2A 2 | | | | | | | | | | | 3A 13 | 4A 14 | 5A 15 | 6A 16 | 7A 17 | 8A 18 | | |
| 1 H 1.01 | | | | | | | | | | | | | | | | | 2 He 4.00 | | | | | | | | | | | 5 B 10.81 | 6 C 12.01 | 7 N 14.01 | 8 O 16.00 | 9 F 19.00 | 10 Ne 20.18 | | |
| 3 Li 6.94 | 4 Be 9.01 | | | | | | | | | | | | | | | | | 11 Na 22.99 | 12 Mg 24.31 | 3B 3 | 4B 4 | 5B 5 | 6B 6 | 7B 7 | 8B 8 | 9B 9 | 10B 10 | 1B 11 | 2B 12 | 13 Al 26.98 | 14 Si 28.09 | 15 P 30.97 | 16 S 32.07 | 17 Cl 35.45 | 18 Ar 39.95 |
| 19 K 39.10 | 20 Ca 40.08 | 21 Sc 44.96 | 22 Ti 47.87 | 23 V 50.94 | 24 Cr 52.00 | 25 Mn 54.94 | 26 Fe 55.85 | 27 Co 58.93 | 28 Ni 58.69 | 29 Cu 63.55 | 30 Zn 65.38 | 31 Ga 69.72 | 32 Ge 72.64 | 33 As 74.92 | 34 Se 78.96 | 35 Br 79.90 | 36 Kr 83.80 | | | | | | | | | | | | | | | | | | |
| 37 Rb 85.47 | 38 Sr 87.62 | 39 Y 88.91 | 40 Zr 91.22 | 41 Nb 92.91 | 42 Mo 95.94 | 43 Tc (98) | 44 Ru 101.07 | 45 Rh 102.91 | 46 Pd 106.42 | 47 Ag 107.87 | 48 Cd 112.41 | 49 In 114.82 | 50 Sn 118.71 | 51 Sb 121.76 | 52 Te 127.60 | 53 I 126.90 | 54 Xe 131.29 | | | | | | | | | | | | | | | | | | |
| 55 Cs 132.91 | 56 Ba 137.33 | 57 La 138.9 | 72 Hf 178.49 | 73 Ta 180.95 | 74 W 183.84 | 75 Re 186.21 | 76 Os 190.23 | 77 Ir 192.22 | 78 Pt 195.08 | 79 Au 196.97 | 80 Hg 200.59 | 81 Tl 204.38 | 82 Pb 207.20 | 83 Bi 208.98 | 84 Po (209) | 85 At (210) | 86 Rn (222) | | | | | | | | | | | | | | | | | | |
| 87 Fr (223) | 88 Ra (226) | 89 Ac (227) | 104 Rf (261) | 105 Db (262) | 106 Sg (266) | 107 Bh (264) | 108 Hs (277) | 109 Mt (268) | 110 Ds (281) | 111 Rg (281) | 112 Cn (285) | 113 Nh (286) | 114 Fl (289) | 115 Mc (289) | 116 Lv (293) | 117 Ts (293) | 118 Og (294) | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|--------------------|--------------------|--------------------|
| 58 Ce 140.1 | 59 Pr 140.9 | 60 Nd 144.2 | 61 Pm (145) | 62 Sm 150.4 | 63 Eu 152.0 | 64 Gd 157.3 | 65 Tb 158.9 | 66 Dy 162.5 | 67 Ho 164.9 | 68 Er 167.3 | 69 Tm 168.9 | 70 Yb 173.0 | 71 Lu 175.0 |
| 90 Th 232.0 | 91 Pa 231.0 | 92 U 238.0 | 93 Np (237) | 94 Pu (244) | 95 Am (243) | 96 Cm (247) | 97 Bk (247) | 98 Cf (251) | 99 Es (252) | 100 Fm (257) | 101 Md (258) | 102 No (259) | 103 Lr (262) |

OTHER USEFUL INFORMATION

Acceleration of gravity at Earth's surface, $g = 9.81 \text{ m/s}^2$

Avogadro's Number, $N = 6.02 \times 10^{23}$ molecules/mole

Planck's constant, $h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$

Planck's reduced constant, $\hbar = h/2\pi = 1.05 \times 10^{-34} \text{ J}\cdot\text{s}$

Standard temperature and pressure (STP) is 0°C and 1 atmosphere

Gram molecular volume at STP = 22.4 liters

Velocity of light, $c = 3.0 \times 10^8 \text{ m/sec}$

Absolute zero = $0 \text{ K} = -273.15^\circ\text{C}$

Gas constant, $R = 1.986 \text{ cal/K}\cdot\text{mole} = 0.082 \text{ liter}\cdot\text{atm/K}\cdot\text{mole}$

One Faraday = 96,500 coulombs ($9.65 \times 10^4 \text{ C}$)

Dulong and Petit's constant = $6.0 \text{ amu}\cdot\text{cal/gram}\cdot\text{K}$

Electron rest mass, $m_e = 9.11 \times 10^{-31} \text{ kg}$

Atomic mass unit, $m_u = 1.66 \times 10^{-27} \text{ kg}$

Boltzmann constant, $k_B = 1.38 \times 10^{-23} \text{ J/K}$

Permittivity of free space $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{N}\cdot\text{m}^2$

Permeability of free space $\mu_0 = 4\pi \times 10^{-7} \text{ T}\cdot\text{m/A}$

1 Atmosphere = $1.02 \times 10^5 \text{ N/m}^2 = 760 \text{ Torr} = 760 \text{ mmHg}$

1 Electron Volt = $1.6 \times 10^{-19} \text{ Joules}$

Charge of an electron = $-1.6 \times 10^{-19} \text{ coulombs (C)}$

1 horsepower (hp) = $746 \text{ W} = 550 \text{ ft}\cdot\text{lb/s}$

Neutron Mass = 1.008665 au

Proton Mass = 1.007277 au

1 au = 931.5 MeV

1 calorie = 4.184 Joules (J)

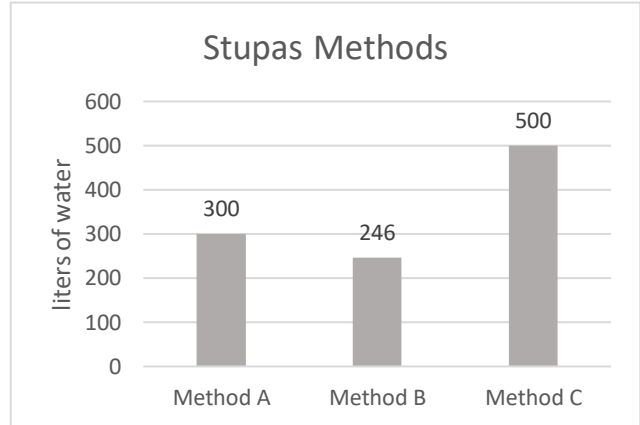
Specific heat of water = $4.18 \text{ J/g}\cdot^\circ\text{C}$

2022-2023 TMSCA Middle School Science Test - #7

1. Andrea is concerned about the loss of glaciers in the mountain areas. She read about how some countries are creating “ice stupas” in the winter to store water for warmer summer days. She conducted an experiment to find the best method to produce an ice stupa. She tried 3 methods and measured the amount of water that was released from her model stupas in the warmer season. Here are her results:

What is the independent variable in this experiment?

- A. the method used
- B. the liters of water released
- C. the height of the ice stupa
- D. the temperature



2. What is the dependent variable in this experiment?

- A. the method used
- B. the liters of water released
- C. the height of the ice stupa
- D. the temperature

3. How many more milliliters of water were released from Method A than Method C?

- A. 200
- B. 200,000
- C. 54
- D. none of these

4. Which method would you chose as the best way to build an ice stupa if you lived in an area that utilized them (based on the results of this experiment)?

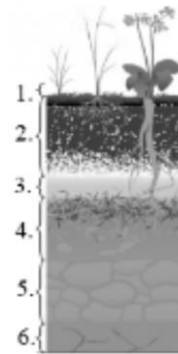
- A. Method A
- B. Method B
- C. Method C
- D. Both A and B

5. Cindy was writing an article describing the parts of a cell. She put titles on each section. One section was titled “Packaging Center”. What part of the cell was this section about?

- A. vacuoles
- B. ribosomes
- C. Golgi apparatus
- D. chloroplasts

6. In this soil profile, where would the O Horizon be located? (it includes organic material in various stages of decomposition)

- A. 1
- B. 2
- C. 3
- D. 4



7. Which of the following fruits are called “pomes”?

- A. apple
- B. pear
- C. grape
- D. Both A and B

8. The after-school science club has been monitoring the creek behind their school for a couple of years. One week, they started noticing frogs with unusual mutations, such as a missing leg, etc. Their teacher said that this could mean there is a problem with the water in the creek. What role were the frogs playing in this scenario?

- A. flagship species B. umbrella species C. indicator species D. Both A and B

9. The satellite radar photo on the right shows Hurricane Fiona. What ocean is this hurricane located in?

- A. Pacific
B. Indian
C. Atlantic
D. Arctic



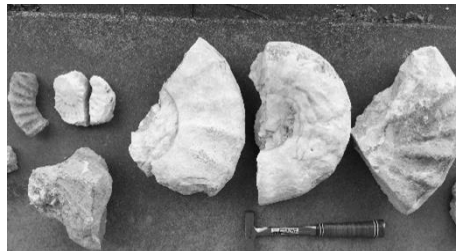
10. What direction is the rotation of Hurricane Fiona in the diagram above?

- A. clockwise B. counterclockwise C. no rotation D. both directions

11. Which of the following descriptions would most likely describe the planet Mars?

- A. a cold desert B. an Earth like planet C. a tropical climate D. a humid dark planet

12. These fossils were found in an outcropping of Cretaceous rock. About how old are these fossils?



- A. 1 billion years old B. 100,000 years old C. 98 million years old D. 100 years old

13. What statement about Earth's gravity is true?

- A. Since Earth is a perfect sphere, the gravity is equal all around the Earth.
B. Earth's gravity is not all equal – there are gravity anomalies.
C. The mountains cause a negative gravity anomaly.
D. The oceans have no effect on gravity at all.



14. Who discovered 4 moons orbiting Jupiter in 1610 with a homemade telescope?

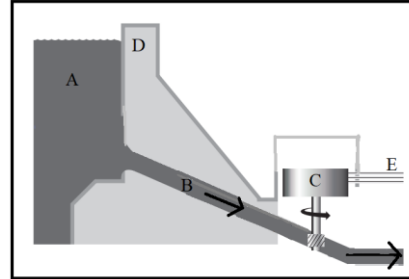
- A. Newton B. Halley C. Galileo D. Tyson

15. Which statement explains the difference between neap and spring tides?

- A. Spring tides only happen in the spring.
B. Neap tides happen when there is a third or first quarter moon.
C. Spring tides happen when the sun and moon are at right angles.
D. Neap tides happen when the sun, Earth, and moon are lined up.

16. The farthest point that the moon is to the Earth is called what?
A. aphelion B. perihelion C. apogee D. perigee

17. Look at this diagram of a hydropower dam.
If area D is the concrete structure holding back the water, what is the penstock?



- A. Location A
B. Location B
C. Location C
D. Location E

18. At what location would you have storage of potential energy?
A. Location A B. Location B C. Location C D. Location D

19. What location shows water with kinetic energy?
A. Location A B. Location B C. Location C D. Location E

20. What location(s) is energy being transformed from kinetic energy to mechanical energy?
A. Location A to B B. Location B to C C. Location C to D D. Location E to A

21. What SI unit is used to measure the intensity of sound?
A. decibel B. hertz C. frequency D. fathom

22. What is the height of a box with the dimensions of 95cm length, 50 cm width, and a volume of 0.095 m³?
A. 10 cm B. 20 cm C. 30 cm D. 40 cm

23. $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
Look at the above chemical equation.
What part of this are the reactants?
A. $\text{CH}_4 + 2\text{O}_2$
B. $2\text{O}_2 \rightarrow \text{CO}_2$
C. CO_2
D. \rightarrow

24. Where on the Periodic Table of the Elements will you find the Alkali metals?
A. far right B. middle C. bottom D. far left

25. Ocean acidification is tied to another factor listed below. What is it?
A. The ocean losing CO_2 into the atmosphere.
B. The circulation of the ocean currents.
C. The ocean taking in more CO_2 from the atmosphere.
D. The migration of the whales to tropical areas in the winter.

26. What layer of Earth's atmosphere is between 50 to 85 km and includes gases that are so thick, that meteors are slowed down and sometimes burn up in this layer?

- A. stratosphere B. thermosphere C. troposphere D. mesosphere

27. Which of the following human-caused activities can cause significant change to watersheds?

- A. ecological succession B. natural rainfall C. urbanization D. recharge

28. Which of the following water-dwelling segmented animals can survive extreme environments, such as the conditions in Antarctica?

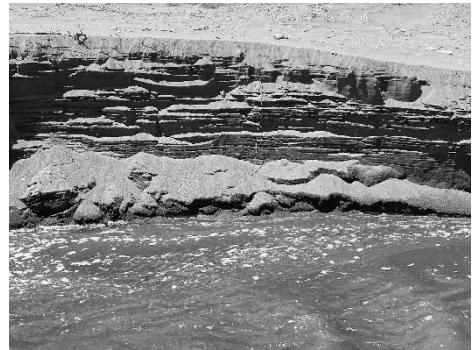
- A. tardigrades B. fleas C. mosquitoes D. axolotls

29. Which term below refers to the structure and dynamics of streams and river corridors?

- A. fluvial B. fry C. karst D. limnetic

30. The stream in this photo has been rushing through this area for many years. As it rushes by, it picks up bits of sediments and carries them away from this part of the stream bed. What geologic term describes this action?

- A. weathering
B. erosion
C. corrosion
D. sedimentation



31. An event in Charles Darwin's life that provided him with an unending number of questions about the natural world was which of these?

- A. reading the book "Zoonomia"
B. taking anatomy classes
C. his South American journeys on the HMS Beagle
D. growing up in Scotland

32. How is "hard" water different than "soft" water?

- A. Hard water has more pressure and comes out of the tap faster.
B. Hard water freezes much slower than soft water.
C. Hard water has molecules with stronger bonds than soft water.
D. Hard water has more calcium and magnesium than soft water.

33. In medical terminology, malignant means what?

- A. non painful B. evil and crafty C. contagious D. harmful to one's health

34. Cetaceans are what?

- A. aquatic B. mammals C. carnivorous D. all the above

35. Spherical or oval shaped bacteria are called what?

- A. bacilli B. spirilla C. cocci D. fusiform

36. Would the sound from strumming a guitar be the same or different if you were inside the international space station than on Earth?

- A. The sound would not travel through the air and would be muffled.
- B. The vibrations from the strumming would not work on the space station.
- C. The sound would be louder than on Earth is strummed the same.
- D. The sound would be the same.

37. Skin, hair, nails, and the sweat and exocrine glands make up what system?

- A. respiratory
- B. integumentary
- C. endocrine
- D. excretory

38. What animal below is most likely a homeothermic animal?

- A. bird
- B. lizard
- C. frog
- D. naked mole rat

39. Janice’s little sister, Peggy, talked about an activity she did in science class. She wrapped a chenille stick around her finger and made a “pretend” insect with antennae. Then Peggy walked her pretend insect finger through a flower shaped plate with yellow powder on it. The yellow powder stuck to the chenille stick. Next, Peggy “flew” her insect from flower to flower as she pretended to drink nectar from each flower. The yellow powder stuck to each flower as she moved from one to the next. Janice told her little sister that by doing this activity, she was learning about what concept?

- A. crystallization
- B. pasteurization
- C. standardization
- D. pollination

40. The time required for the half of the radioactive sample to decay is called what?

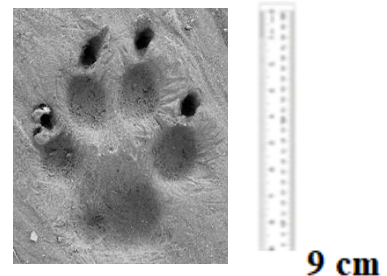
- A. farad
- B. half-life
- C. focal length
- D. refraction index

41. What is the SI unit of measurement of electrostatic potential?

- A. Tesla (T)
- B. Newton (N)
- C. Volt (V)
- D. Ampere (A)

42. Sammy and his class built a garden on their school grounds. Overnight, an animal of some type tramped around in the garden and destroyed some of the plants. They found some animal tracks the next morning. What type of animal most likely left the footprint?

- A. squirrel
- B. dog
- C. bobcat
- D. opossum



43. Which of the following “fruit” types is called a hesperidium?



- A.**
- B.**
- C.**
- D.**

44. What element that has 50 protons and in group 4A on the Periodic Table?

- A. Strontium B. Tin C. Antimony D. Selenium

45. The longhorn tick has an unusual reproductive phenomenon. The female lays eggs that hatch into healthy offspring even though they have not been fertilized by a male. This is known as what?

- A. Embryonic B. Oogenesis C. Fragmentation D. Parthenogenesis

46. Living in outer space can cause changes to the human body. Because they couldn't go into space to try an experiment, Jenny's class investigated to determine how the human body changed in a "simulated" space activity. First, they measured the circumference of their legs, necks, and heads while they were standing normally. Next, they measured the circumference of their legs, necks, and heads while lying on the floor (semi-inverted) with their legs elevated up against a wall after 30 minutes. They wanted to see if there were any differences in the circumferences in the different positions.

Here are Jenny's results:

| Body Part | Circumference (cm) while standing | Circumference (cm) while being inverted for 30 minutes. |
|------------|-----------------------------------|---|
| leg (calf) | 32 | 31.4 |
| neck | 26 | 25.9 |
| head | 54 | 54.8 |

What conclusion can be made about Jenny's results?

- A. While being inverted, Jenny's head circumference decreased slightly.
B. While standing, Jenny's head measurement, neck measurement, and leg measurement were all much smaller than when she was inverted.
C. While being inverted, Jenny's leg measurement decreased while her head measurement increased slightly.
D. By being inverted, Jenny's measurements didn't really change much so her position didn't matter at all.

47. Jenny's teacher instructed the class to write a statement about what they learned from the activity. Which statement below would be the best statement for Jenny to write?

- A. When astronauts go into space, their measurements will most likely stay the same and will not be affected by any changes in gravity.
B. When astronauts go into space, they will need to be aware that the blood in their body can be affected by gravity or low gravity conditions which might change their body measurements.
C. Because there were slight differences when I was upside down or standing right side up, the astronauts don't need to be concerned with anything about their body measurements in space.
D. Astronauts need to train while being upside down so they will get used to being in space.

48. A rocket travelled 1,000 meters which took about 5.2 seconds. What is the average speed of the rocket?

- A. 52 meters per second
- B. 1005.2 meters per second
- C. 400 meters per second
- D. 192.3 meters per second

49. Which fact about the moon is not true?

- A. The moon's gravity is one-sixth that of Earth's.
- B. The moon is a perfect sphere.
- C. The first moon landing happened in 1969.
- D. The first moon landing location was named Tranquility Base.

50. Which of the following statements describes an object with kinetic energy?

- A. a car parked in a parking garage
- B. a bicycle leaning against a wall
- C. a hot air balloon slowly rising in the sky
- D. a rock sitting on the sidewalk



2022 - 2023 TMSCA Middle School Science #7 Test - Key

- | | | |
|-------|-------|-------|
| 1. A | 18. A | 35. C |
| 2. B | 19. B | 36. D |
| 3. D | 20. B | 37. B |
| 4. C | 21. A | 38. A |
| 5. C | 22. B | 39. D |
| 6. A | 23. A | 40. B |
| 7. D | 24. D | 41. C |
| 8. C | 25. C | 42. B |
| 9. C | 26. D | 43. D |
| 10. B | 27. C | 44. B |
| 11. A | 28. A | 45. D |
| 12. C | 29. A | 46. C |
| 13. B | 30. B | 47. B |
| 14. C | 31. C | 48. D |
| 15. B | 32. D | 49. B |
| 16. C | 33. D | 50. C |
| 17. B | 34. D | |