

**TMSCA MIDDLE SCHOOL
SCIENCE
TEST #11 ©
FEBRUARY 11, 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	9 9	10 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 - #11

1. What would be a possible goal for an environmental engineer?

- A. to design a stronger bridge for trains to cross
- B. to design and build an aircraft
- C. to decrease water and air pollution
- D. to develop a new medicine

2. reactants → **products**

In a chemical reaction, if more energy is released when the products form bonds than it takes for the reactants to break apart, then the reaction is what?

- A. endothermic and the temperature increases
- B. exothermic and the temperature increases
- C. endothermic and the temperature decreases
- D. exothermic and the temperature decreases

3. $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

How many atoms make up the products in the above chemical equation?

- A. 10
- B. 20
- C. 30
- D. 40

4. The membrane structures found in eukaryotic cells that enable cells to live and reproduce are called what?

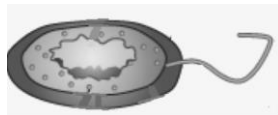
- A. stomata
- B. organelles
- C. bacterium
- D. prokaryotes

5. What type of cell is green algae made of?

- A. prokaryotic
- B. eukaryotic
- C. stomatic
- D. nucleic

6. Look at this cell diagram.

What statement below is true about this cell?



- A. The cell is a eukaryotic cell.
- B. The cell has a membrane bound organelle called a nucleus.
- C. The cell has a “tail” like structure called a flagellum.
- D. The cell most likely belongs to a plant.

7. An organism that lives near termites so that they can scavenge, steal food, or prey on them is called what?

- A. insecticide
- B. termitophile
- C. helminths
- D. ectoparasite

8. What part of an insect’s body has the attachments of wings and legs?

- A. abdomen
- B. thorax
- C. head
- D. all three parts

9. Who is recognized as the person who discovered “electrons” in 1897?

- A. J.J. Thomson
- B. Ernest Rutherford
- C. John Dalton
- D. Niels Bohr

10. What month is Earth the closest to the sun?

- A. December
- B. January
- C. March
- D. July

11. DNA molecules have rungs that are composed of two bases that pair with each other. Which combination of these base pairings below is correct?

- A. Adenine – Uracil
- B. Cytosine – Thymine
- C. Guanine – Cytosine
- D. Cytosine – Adenine

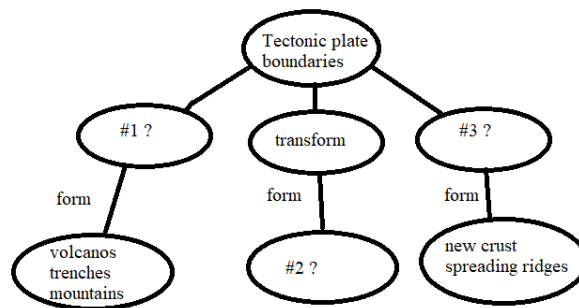
12. What do scientists sometimes use to determine the climate of the Earth thousands of years ago?

- A. man-made satellites
- B. ice cores from Antarctica
- C. Voyager I
- D. moonlight

13. Look at this concept map.

What words would you place in the spot designated #1?

- A. earthquakes, linear valleys
- B. transform boundary
- C. convergent boundary
- D. divergent boundary



14. A television set was turned on and a news program was being telecast. What energy transformations happened with this event?

- A. chemical energy to heat energy to sound energy
- B. electrical energy to potential energy to heat energy
- C. electrical energy to light, sound, and heat energy
- D. mechanical energy to electrical energy to kinetic energy

15. Look at the data given below. What else do you need to calculate average velocity?

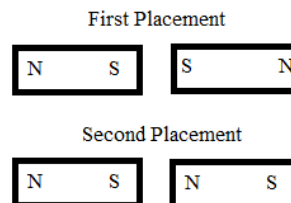
Displacement (55 meters to the west)

- A. the mass of the object
- B. the type of transportation
- C. how far the object travelled
- D. the time it took to travel

16. Look at the Second Placement of the magnets.

What would happen to the magnets in this position?

- A. They would pull together.
- B. They would push apart.
- C. They will stay in the same position.
- D. They would move perpendicular to each other.



17. Out of the following temperatures, which is the lowest or coldest?

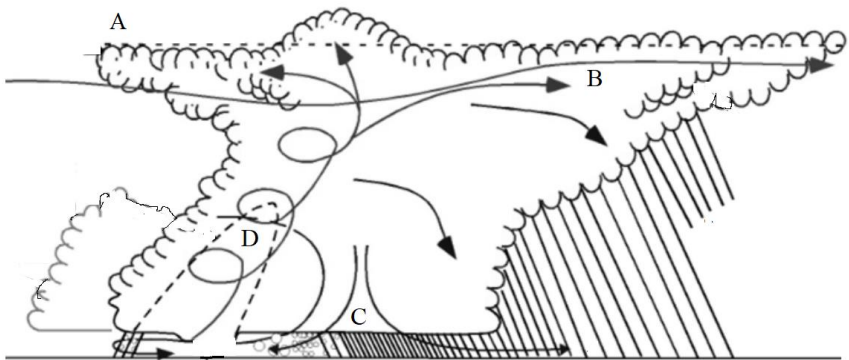
- A. 100 degrees Celsius
- B. 100 degrees F
- C. 100 K
- D. They are all the same.

18. Gallium has a melting point of 29.8 degrees C. If a human were able to hold it in his/her hand, what would happen to this metal?

- A. It would freeze solid.
- B. It would melt into a liquid.
- C. It would remain in the same state of matter.
- D. It would burn a hole through the hand.

19. Which of the following chemical equations is balanced?

- A. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$
- B. $Zn + 2HCl \rightarrow 3ZnCl_2 + H_2$
- C. $Zn + 4HCl \rightarrow ZnCl_2 + H_2$
- D. $Zn + 2HCl \rightarrow ZnCl_2 + 7H_2$



20. What part of this thunderstorm diagram represents the anvil formation?

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

21. What part of this thunderstorm diagram represents the outflow?

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

22. The formation labeled "D" represents what?

- A. anvil
- B. mesocyclone
- C. rain wall
- D. outflow

23. Abiotic factors of the ocean would include what?

- A. salinity, plankton abundance
- B. oxygen content, temperature, pH, light, salinity
- C. nekton population, benthic population, temperature
- D. all the above

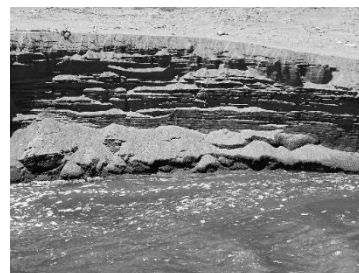
24. This cloud shows the buildup of convective currents and rain showers. What type of cloud is this?

- A. stratus
- B. cumulonimbus
- C. cirrus
- D. altostratus



25. What layer of the atmosphere is known as the “upper atmosphere” and lies between 85 to 600 km?
 A. stratosphere B. thermosphere C. troposphere D. mesosphere
26. A 3-dimensional shape map of the land surface which can help to determine the boundaries of watersheds is called a what?
 A. economic B. topographical C. climatic D. Both A and C
27. What is another name for a watershed?
 A. drainage basin B. delta C. riparian zone D. none of these
28. The area of vegetation adjacent to a stream is called what?
 A. delta B. riparian zone C. headwater D. Both A and C
29. What person wrote a book called “Silent Spring” that influenced an environmental movement and the creation of the United States Environmental Protection Agency?
 A. Rachel Green B. Jane Goodall C. Rachel Carson D. Dorothy Woodsworth

30. What environmentally friendly measures could be taken to keep this stream bank from being carried away by the water in the stream?
 A. Native plants would be added to stabilize the stream bank.
 B. Concrete walls could be added to the bank.
 C. A pipeline could be built in the area to move the stream flow to another place.
 D. A combination of both B and C could be used.



31. Jenny took a balloon and filled it with baking soda. Then she took a plastic bottle and filled it with vinegar. Next, she put the lip of the balloon over the plastic bottle and let the baking soda fall into the bottle. The balloon began to fill up with gas. Which statement below about Jenny’s investigation is true?
 A. The baking soda in the balloon caused the air in the bottle to rise.
 B. The baking soda in the balloon and the vinegar in the bottle combined which caused a physical reaction and the air become “excited” which caused it to rise into the balloon.
 C. When the baking soda and the vinegar in the bottle combined, a chemical reaction took place releasing carbon dioxide gas that filled the balloon.
 D. The mixture of the baking soda and vinegar created hydrogen gas which filled the balloon.
32. Which of the chemical equations below best shows what happens when baking soda and vinegar combine?
 A. $\text{NaHCO}_2 + \text{NaHCO}_2 \rightarrow 7\text{CO}_2$
 B. $\text{NaHCO}_3 + \text{HC}_2\text{H}_3\text{O}_2 \rightarrow \text{NaC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{O} + \text{H}_2$
 C. $\text{CH}_3\text{COOH} + \text{NaHCO}_3 \rightarrow \text{CH}_3\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$
 D. $\text{NaHCO}_3 + \text{NaCl} \rightarrow \text{NaC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{O} + \text{CO}_2$

33. Out of all the following choices listed, which has the most effect on an area's climate?
- A. soil and rock types
 - B. topography and distance from equator
 - C. number of forests in the region
 - D. population of insects

34. Which list below shows substances that are all basic? (not acidic)
- A. orange juice, sodium hydroxide, lime juice
 - B. milk, lemon juice, vinegar
 - C. urine, bananas, orange juice
 - D. toothpaste, soapy water, bleach

35. What military navigation system(s) is based on the same way that bats use echolocation?
- A. sonar
 - B. radar
 - C. drones
 - D. both A and B

36. What does the prefix "hetero" mean?
- A. same
 - B. outward
 - C. different
 - D. total

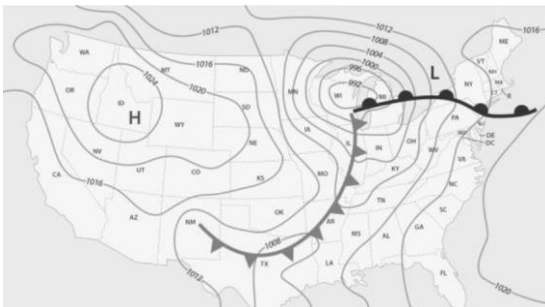
37. A rock expert that gets paid for his/her expertise is called what?
- A. petrologist
 - B. dipterologist
 - C. entomologist
 - D. toxicologist

38. Which statement below about clouds is true?
- A. Clouds are made of water vapor.
 - B. Clouds can be made of water droplets or ice crystals.
 - C. Clouds only form in daytime hours.
 - D. Clouds are only made of liquid water.



39. The plant in the photo has spines. What part of the plant are the spines?
- A. stems
 - B. modified leaves
 - C. roots
 - D. flowers

Use the weather map below to answer the questions.



40. What does the "H" on this map stand for?
- A. hail
 - B. heat wave
 - C. haze
 - D. high pressure

41. Look at this list of items.

clear glass window, see-through cellophane, clean air, clean water

All of these are examples of what?

- A. translucent materials
- B. transparent materials
- C. opaque materials
- D. none of the above

42. Alex has three blocks of wood that have exactly the same volume. Block X has a mass of 5 grams, Block Y has a mass of 20 grams, and Block Z has a mass of 15 grams. If Alex applies the same force to each of the blocks in the same direction, which block will have the most acceleration?

- A. X
- B. Y
- C. Z
- D. They will be equal.

43. Which of the following “fruit” types is called an achene?



A.



B.



C.



D.

44. A Great-horned owl will eat a skunk. A skunk will eat small lizards and fruits. A small lizard will eat insects such as grasshoppers. Grasshoppers eat mainly plants. Use these descriptions to draw the food chains. The owl would be considered what?

- A. secondary consumer
- B. secondary producer
- C. quaternary consumer
- D. Both A and C



45. In this description, what would the small lizard be classified as?

- A. primary consumer
- B. secondary consumer
- C. tertiary consumer
- D. quaternary consumer

46. In this description, what would the skunk be classified as?

- A. omnivore
- B. primary consumer
- C. tertiary consumer
- D. all of these

47. A book was on a table not moving. The book continues to stay on the table without moving. This is an example of what?

- A. Newton’s First Law of Motion
- B. Law of Inertia
- C. Law of Momentum
- D. Both A and B

48. When the lenses are thinner in the middle and thicker on the edges which causes a curve inward this is what type of lens?

- A. concave B. convex C. refracted D. concentrated

49. A simple machine that gives a mechanical advantage on a fulcrum is called what?

- A. lever B. wheel C. inclined plane D. screw

50. Which law states that the volume of a gas decreases when the pressure increases if the temperature remains the same?

- A. Boyle's Law B. Farad's Law C. Newton's Law D. Charles's law

2022 - 2023 TMSCA Middle School Science #11 Test - Key

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