

**TMSCA MIDDLE SCHOOL  
SCIENCE  
TEST #10 ©  
FEBRUARY 4, 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<sup>x</sup>, ln x, y<sup>x</sup>, sin x, sin<sup>-x</sup>, cos x, cos<sup>-x</sup>, tan x, tan<sup>-x</sup>, 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  $0^\circ\text{C}$  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 - #10

1. Hand warmers can be useful when someone needs to be outside during cold weather. A hand warmer contains iron, water, activated carbon, vermiculite, cellulose, and salt. What causes the heat energy to be released?

- A. The activated carbon burns when exposed to the salt which makes heat.
- B. The vermiculite reacts with the cellulose and ignites the iron to burn.
- C. When all these ingredients mix, heat energy is created.
- D. When the iron is exposed to the air, it oxidizes and releases heat energy.



2. Which of the following chemical equations below is balanced?

- A.  $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 4H_2O$
- B.  $2C_2H_6 + 7O_2 \rightarrow 2CO_2 + 3H_2O$
- C.  $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$
- D.  $2C_2H_6 + 2O_2 \rightarrow 4CO_2 + 6H_2O$

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

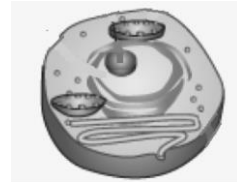
How many atoms make up the reactants in the above chemical equation?

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

4. Look at this diagram of a cell.

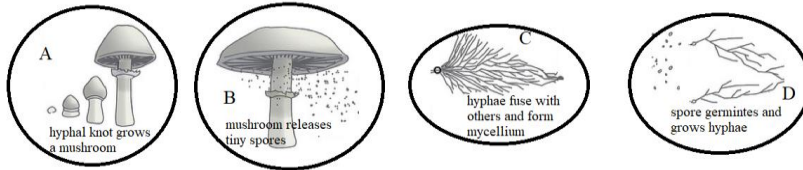
Which statement below about this cell is true?

- A. This cell is a prokaryotic cell.
- B. This cell has no organized organelles.
- C. This cell has membrane bound organelles including a nucleus.
- D. This cell is a bacterium.



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

- A. nucleus
- B. cytoskeleton
- C. ribosomes
- D. lysosomes



6. The diagram above is not necessarily in the correct order for the life cycle of a mushroom. Which is the correct order?

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

7. The midden area around a red harvester ant den is used by the ants for what?

- A. defense
- B. recreation
- C. reproduction
- D. refuse area

8. Look closely at this baked piece of homemade yeast bread. You notice “holes” throughout the texture of the bread.



What caused those “holes”?

- A. While baking, the heat caused air to rise in the bread.
- B. The baking soda in the recipe trapped air bubbles in the dough.
- C. When the flour mixed with the liquids used a chemical reaction took place.
- D. The yeast fed on the carbohydrates in the dough and released carbon dioxide bubbles.

9. Red harvester ants (*Pogonomyrmex barbatus*) are one of the favorite food sources of the Texas Horned Lizard (*Phrynosoma cornutum*). These ants live in a colony of about 10,000 individuals with one queen. Which statement below is not true about these insects?

- A. The queen ant can live around 15 to 20 years.
- B. The worker ants are sterile females.
- C. Red harvester ants will forage (look for food) 24 hours a day.
- D. Grass seeds make up most of their diet.

10. What organism reproduces both asexually and sexually?

- A. rabbits
- B. jellyfish
- C. flies
- D. mussels

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

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

12. Who was the first female pilot to fly solo across North America and back again in 1928? She was also known as the “Queen of the Air”.

- A. Dora Marquez
- B. Elinor Smith
- C. Willa Brown
- D. Amelia Earhart

13. What planet has been studied the most by people?

- A. Mars
- B. Mercury
- C. Venus
- D. Earth

14. What forms on dry land when an eroding stream changes rapidly into a depositing stream? (usually from a mountain stream flowing into a flat plain)

- A. an alluvial fan
- B. glacial till
- C. delta
- D. placer deposit

15. Look at this photograph of a rock surface that shows “ripples”. Which statement below most likely explains this geological phenomenon?

- A. These “ripples” were tracks made by giant land worms over time wearing away the surface of the rock.
- B. This area was underwater and was most likely the bottom of the ocean.
- C. These “ripples” were made when a person took a stick and carved out the lines just for the fun of it.
- D. These “ripples” were formed when an ancient sea shoreline underwent lithification showing the rise and fall of the shoreline over time.



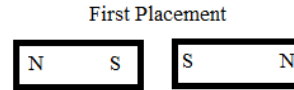
16. Which of the following people experimented with alpha and beta rays in 1899 using thin metal foil sheets?

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

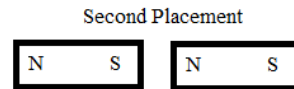
17. Which of the following planets is larger than Earth?  
A. Venus                      B. Mars                      C. Saturn                      D. Mercury

18. What is the best geometric shape for structural support in construction?  
A. square                      B. triangle                      C. parallelogram                      D. circle

19. Look at the First 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.



20. A ping pong ball with a mass of 2 g and a volume of 40.68 cm<sup>3</sup> can float on water. Which of the following would be about the correct density of the ping pong ball?

- A. 1.049 g/cm<sup>3</sup>
- B. 0.049 g/cm<sup>3</sup>
- C. 4.9 g/cm<sup>3</sup>
- D. .80 g/cm<sup>3</sup>

21. What is another name for a negatively charged ion?  
A. anion                      B. cation                      C. potion                      D. notion

22. Which statement below about the oceans is not true?  
A. Ocean water has a higher electrical conductivity than freshwater.  
B. A balance of pH is vital to a healthy marine ecosystem.  
C. Ocean water's freezing point is slightly higher than freshwater.  
D. The density of ocean water is higher than freshwater.

23. There was a problem with pollution at a nearby lake. An investigation took place, and it was determined that the problem was caused by anthropogenic means. What does this mean?

- A. chemical pollution
- B. people caused
- C. environment related
- D. time related

24. The Little Wichita River eventually runs into the Red River. That makes the Little Wichita River a what?

- A. playa
- B. intermittent
- C. lentic
- D. tributary

25. When bats use echolocation, they send out sound waves through what?

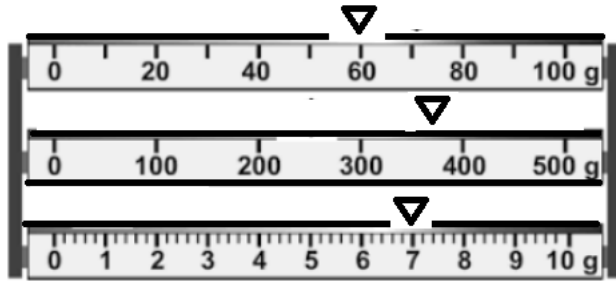
- A. mouth
- B. nose
- C. ears
- D. both A and B

26. When a non-native species in an ecosystem becomes self-sustaining, it becomes what?

- A. naturalized species
- B. core species
- C. invasive species
- D. biological control

27. What order of insects contains about 40% of all the known species?

- A. Coleoptera
- B. Lepidoptera
- C. Diptera
- D. Hymenoptera



28. Linda was measuring the mass of an object on the triple beam balance scale. She made a mistake. What mistake did she make?

- A. She placed the slider on the “notch” of 7 on the bottom bar.
- B. She moved the top bar slider too far to the right.
- C. She didn’t place the slider in the “notch” on the middle bar.
- D. She made no mistake.

29. What two systems are responsible for movement in the body?

- A. renal and respiratory
- B. digestive and circulatory
- C. muscular and skeletal
- D. endocrine and immune

30. What mammal below is a poikilothermic animal?

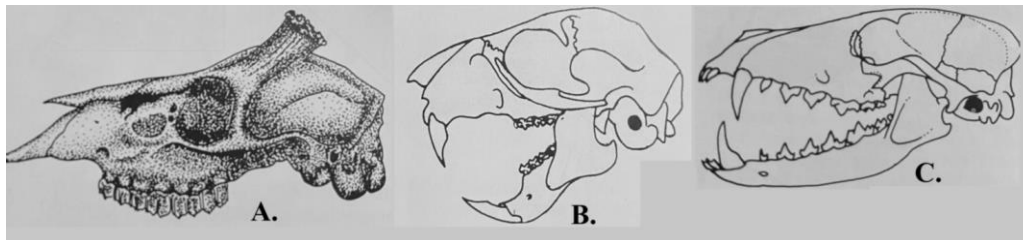
- A. naked mole rat
- B. beaver
- C. field mouse
- D. opossum

31. Which of the following statements about air is not true?

- A. Air takes up space and has mass.
- B. Air can be compressed.
- C. Air is a heterogenous mixture of gases.
- D. Air is affected by altitude.

32. Discrete units of energy associated with light are called what?

- A. photons
- B. nucleons
- C. quarks
- D. electrons



33. Which of the above skulls is most likely a carnivore?

- A. A
- B. B
- C. C
- D. none of these

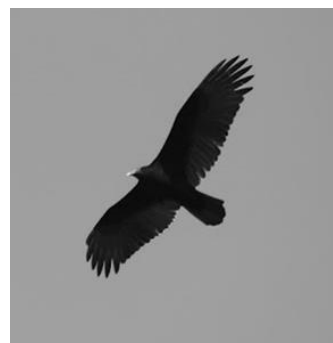
34. Solar winds can cause disturbances on Earth to which of these entities?
- A. ocean waves
  - B. earthquakes, tsunamis, hurricanes, volcanos
  - C. the jet stream
  - D. satellites, spacecraft, and the Earth's electric-power grid
35. In the electromagnetic spectrum, waves are arranged by the size of the wavelengths. Which list below is a correct arrangement from longest to shortest wave?
- A. gamma rays, x-rays, infrared, ultraviolet, visible light, microwave, radio waves
  - B. radio waves, infrared, microwaves, ultraviolet, visible light, gamma rays, x-rays
  - C. infrared, visible light, ultraviolet, radio waves, microwaves, x-rays, gamma rays
  - D. radio waves, microwaves, infrared, visible light, ultraviolet, x-rays, gamma rays
36. If a hippopotamus and a frog were both dropped from a 20-story building at the same time (hypothetically of course, it would be cruel otherwise) with no air resistance, which one would hit the ground first?
- A. The hippopotamus would have more mass and would hit the ground first.
  - B. The hippopotamus would fall faster at first and then slow down because of its greater mass so the frog would hit the ground first.
  - C. Both the hippopotamus and the frog would hit the ground at the same time.
  - D. The frog having a smaller mass would hit the ground first.
37. What is a useful characteristic of an electromagnet that permanent bar magnets don't have?
- A. An electromagnet can pick up iron objects.
  - B. An electromagnet can be turned on and off.
  - C. An electromagnet can be moved to different places.
  - D. An electromagnet costs more than most permanent bar magnets which are cheap.
38. When atoms have the same number of protons, but the neutron numbers can vary, they are called what?
- A. ions
  - B. isotopes
  - C. neutrinos
  - D. hadrons
39. A substance that cannot be broken down into two or more simpler substances is known as what?
- A. element
  - B. solution
  - C. mixture
  - D. compound
40. The element Nihonium (113) is named after what?
- A. a city in France
  - B. a scientist from Asia
  - C. a type of animal
  - D. the country of Japan
41. Which of these elements is the most reactive? (Li, Cs, K, Na)
- A. Li
  - B. Cs
  - C. K
  - D. Na

42. On the Periodic Table of the Elements, the table is arranged in order of increasing what?  
A. alphabetical order    B. proton number    C. positive charge    D. atoms

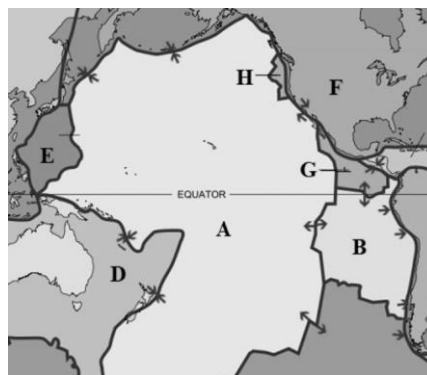
43. Which of the following statements describes the same book with the most potential energy?  
A. a book sitting on the top shelf of a 10-foot bookcase  
B. a book sitting on the floor of the room  
C. a book in the hands of a person sitting in a chair 3 feet high  
D. a book resting on the top of the empire state building

44. George has three blocks of wood with exactly the same size and shape. 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 George applies the same force to each of the blocks in the same direction, which block will have the least acceleration?  
A. X                      B. Y                      C. Z                      D. They will be the same.

45. This photo is a bird known as a turkey vulture.  
Which statement below is not true about this bird?  
A. Turkey vultures have a keen sense of smell.  
B. Turkey vultures' heads are "bald" so that carrion doesn't stick to it when they are eating.  
C. Turkey vultures are also officially classified as buzzards.  
D. Turkey vultures are scavengers.



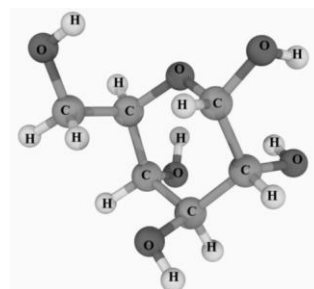
46. What tectonic plate is labeled with the letter F?  
A. California plate  
B. North American plate  
C. Pacific plate  
D. Juan de Fuca plate



47. What tectonic plate is labeled with the letter A?  
A. Australian plate  
B. Nazca plate  
C. Atlantic plate  
D. Pacific plate

48. Which of the following substances is/are hydrophobic?  
A. fats                      B. oils                      C. alkanes                      D. all of these

49. The model on the right represents what important molecule?  
A. water  
B. sodium chloride  
C. caffeine  
D. glucose





50. Jamaal wanted to find out if a sweet potato would grow more “slips” if they are peeled than if they are not peeled. (Slips are cuttings from sprouts on sweet potatoes.) He set up one sweet potato (unpeeled) with toothpicks over a cup of water and another sweet potato (peeled) over a different cup of water. He made sure both cups were placed in a window that received the same sunlight.

Which chart would be the best for data collection in Jamaal’s journal during the experiment?



A.

Sample	Week 1 Hrs of sunlight	Week 2 Hrs of sunlight	Week 3 Hrs of sunlight	Week 4 Hrs of sunlight	Week 5 Hrs of sunlight	Week 6 Hrs of sunlight	Week 7 Hrs of sunlight
Peeled potato							
Unpeeled potato							
Observations/notes							

B.

Sample	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Peeled potato							
Unpeeled potato							
Observations/notes							

C.

Sample	Week 1 (# of slips)	Week 2 (# of slips)	Week 3 (# of slips)	Week 4 (# of slips)	Week 5 (# of slips)	Week 6 (# of slips)	Week 7 (# of slips)
Peeled potato							
Unpeeled potato							
Observations/notes							

D.

Sample	Week 1 (water in cup)	Week 2 (water in cup)	Week 3 (water in cup)	Week 4 (water in cup)	Week 5 (water in cup)	Week 6 (water in cup)	Week 7 (water in cup)
Peeled potato							
Unpeeled potato							
Observations/notes							

**2022 - 2023 TMSCA Middle School Science #10 Test - Key**

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