

**TMSCA MIDDLE SCHOOL  
SCIENCE  
TEST #12 ©  
FEBRUARY 18, 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																	8A 18
1 H 1.01																	2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3B 3	4B 4	5B 5	6B 6	7B 7	8 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  $0^\circ\text{C}$  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

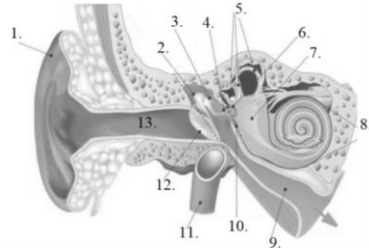
1 au = 931.5 MeV

1 calorie = 4.184 Joules (J)

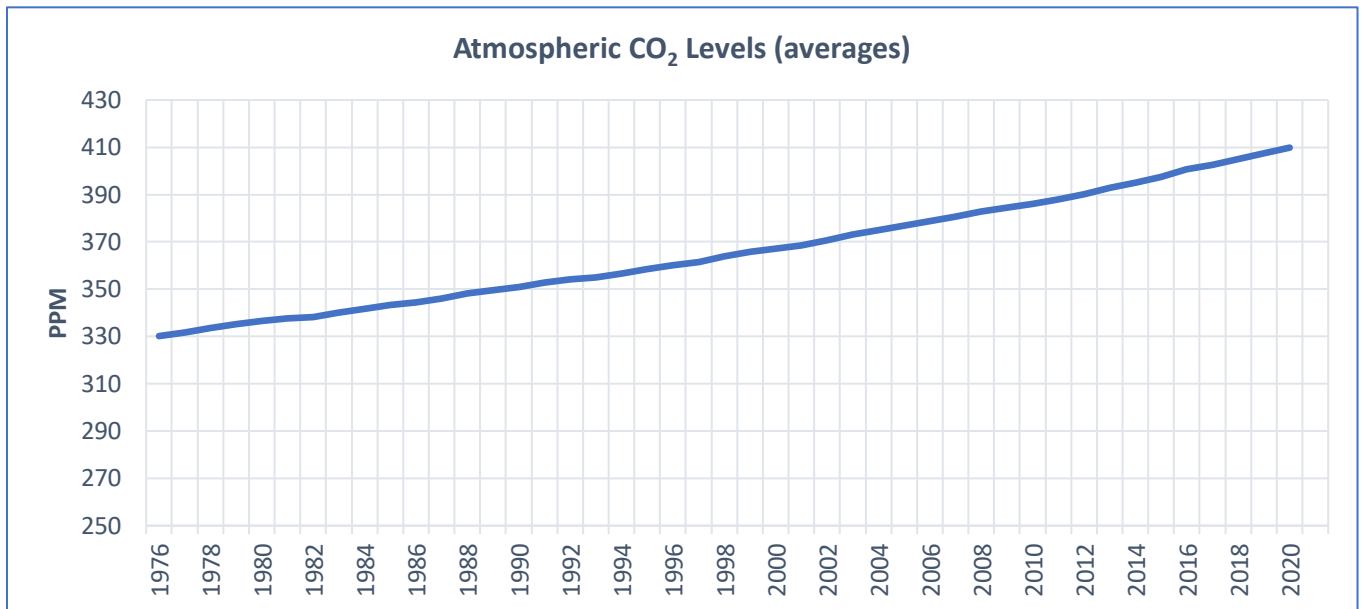
Specific heat of water =  $4.18 \text{ J/g}\cdot^\circ\text{C}$

2022-2023 TMSCA Middle School Science Test - #12

1. What would be a possible goal for a nuclear engineer?  
A. to decrease the number of materials in a new skyscraper  
B. to ensure the safety of people living around a reactor  
C. to develop a plastic that can decompose  
D. to design a tunnel that goes through a mountain
2. The main purpose of a catalyst in a chemical reaction is to do what?  
A. split the parts of the reaction  
B. stop the reaction  
C. add heat to the reaction  
D. speed up the reaction
3. What is another name for a positively charged ion?  
A. anion                      B. cation                      C. bation                      D. potion



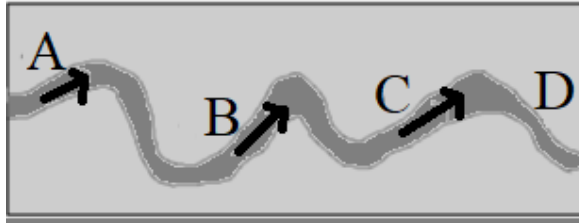
4. Where is the eustachian tube in the above diagram?  
A. 2                      B. 9                      C. 11                      D. 13
5. All living things what?  
A. have mothers and fathers    B. are made of cells                      C. move around                      D. have toes
6. Engineers have been using the inspiration of nature and biological entities to design structures, materials, and systems. The practice of doing this is called what?  
A. sheer resistance    B. plasticizing                      C. biomimicry                      D. cross linking
7. Which of the following diseases are caused by insect bites?  
A. Malaria                      B. Chagas                      C. Mononucleosis                      D. Both A and B
8. Most bees native to North America are what type?  
A. communal                      B. solitary                      C. semisocial                      D. eusocial
9. What body system delivers nutrients and oxygen to the cells and organs and carries the waste products away?  
A. circulatory                      B. excretory                      C. urinary                      D. nervous
10. Large pieces of the lithosphere that move around on the Earth's surface are called what?  
A. faults                      B. tectonic plates                      C. continents                      D. crust



11. The graph above shows the CO<sub>2</sub> levels (average) in the atmosphere as taken from a station in Australia over the years. Which statement below is true according to this graph?
- The CO<sub>2</sub> levels have continually decreased over the last 50 years.
  - PPM stands for pages per minutes in this graph.
  - The CO<sub>2</sub> level averages have continually increased from 1976 to 2020.
  - The CO<sub>2</sub> level average in 2021 should be less than 410 ppm.
12. According to this graph, the CO<sub>2</sub> atmosphere levels average in 2001 would be about what?
- more than 370, but less than 380
  - between 360 and 380
  - exactly 350
  - between 330 and 350
13. What is a difference(s) between an alluvial fan and a delta?
- A delta is a landform in a triangular shape and an alluvial fan is not.
  - A delta forms from the deposition of sediments carried by water and an alluvial fan is not.
  - An alluvial fan is found at low elevations and a delta is found at higher elevations.
  - An alluvial fan forms on dry land and a delta forms where a river or stream meet an estuary.
14. The dwarf planet Pluto has an orbit that allows it to be closer to the sun than what planet (at times)?
- Mars
  - Jupiter
  - Neptune
  - Venus
15. The device that is used to determine the specific heat capacity of a substance is called what?
- fulcrum
  - calorimeter
  - kinetic meter
  - velocitor
16. What is the gradual increase in world temperatures due to an increase of carbon dioxide and other pollutants in the atmosphere which trap in excess heat energy?
- global warming
  - fervency
  - thermodynamics
  - Both A and C

17. Which grass listed below is known as an “invasive species” and out competes the native grasses for resources in Texas?

- A. little bluestem      B. switchgrass      C. buffalo grass      D. Johnson grass



18. Use the diagram above of a river to answer the following questions. Which point is most likely the highest elevation?

- A. A      B. B      C. C      D. D

19. What statement about the river in the diagram is true?

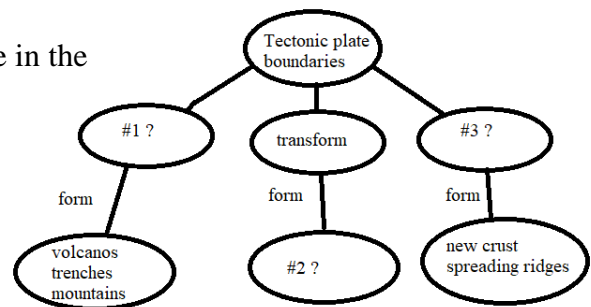
- A. The river is a very young river because of its shape.  
 B. This river has several meanders and is a more mature river.  
 C. This river is flowing extremely fast due to its shape.  
 D. Point C is higher in elevation than Point A.

20. If a beaver were to build a dam at Point C, then what would happen?

- A. A pond would form between Point B and C.  
 B. A pond would form between Point C and D.  
 C. There would be more water at point D than there is now.  
 D. The dam would cause no change in the river.

21. On this concept map, what word would you place in the spot designated #2?

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



22. What steps do you follow to convert a Fahrenheit temperature to Celsius?

- A. 1) Multiply the number by 9. 2) Divide that by 5. 3) Add that to 32.  
 B. 1) Subtract 32 from the number. 2) Multiply that by 5. 3) Divide that by 9.  
 C. 1) Add 32 to the number. 2) Divide by 5. 3) Multiply by 9.  
 D. 1) Divide by 5. 2) Multiply by 12 3) Add 212

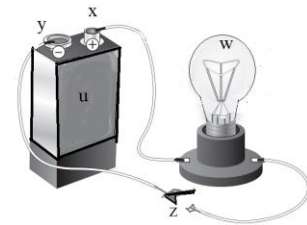
23. Some meteorologists are predicting that areas being affected by extreme drought are going through a process called what?

- A. desertification      B. climatology      C. sustainability      D. ozonation

24. How does a hot air balloon work?
- A. The air is heated by a heat source which makes it less dense, so it rises.
  - B. The air is pumped with helium which makes it rise.
  - C. The air is warmed by fire which starts the engine to make it fly.
  - D. The air inside the balloon becomes cooler than the surrounding air which causes a change in the pressure and the balloon rises.

25. Which of the following are physical properties of water?
- A. reacts with sodium
  - B. has a melting point of 0 degrees Celsius
  - C. is colorless
  - D. Both B and C

26. In this circuit, which statement below is true?
- A. The electricity will travel from point X to W in that direction.
  - B. The load in this circuit is at point W.
  - C. The circuit is complete in the diagram.
  - D. U is called the switch for the circuit.



27. An aquatic animal that feeds by allowing tiny organisms or fine particles of organic matter from water to pass through the organism is called what?
- A. an oyster
  - B. a filter feeder
  - C. a mussel
  - D. all of these

28. The lake had a very warm temperature on its surface. This layer is called what?
- A. epilimnion
  - B. hypolimnion
  - C. benthic
  - D. Both A and B

29. A sudden change of depth in one or more of the physical properties of the material making up Earth's interior is called what?
- A. discontinuity
  - B. exfoliation
  - C. pyroclastic
  - D. drumlin

30. Millions of bats are dying from a disease called White-nose syndrome. This disease is caused by a fungus that does what?
- A. eats away at their noses which destroys their respiration
  - B. suffocates them by blocking their airways and causing heart distress
  - C. destroys their calcium in their bones
  - D. disturbs the bats during hibernation which depletes their energy stores

31. What travels at about 186,000 miles per second?
- A. sound
  - B. gas
  - C. light
  - D. all of these

32. During mitosis, the chromatids (chromosomes) move to opposite poles of the cell during what stage?
- A. Prophase
  - B. Metaphase
  - C. Interphase
  - D. Anaphase A

33. Which statement about desert regions is not true?
- A. To be a desert, the area receives less than 25 cm of rainfall a year.
  - B. Deserts may have extreme temperatures from very hot to very cold.
  - C. Antarctica is classified as a desert.
  - D. Deserts have little or no biodiversity of life.

34. Look at this diagram.

In what region is the transfer of heat energy taking place by convection?



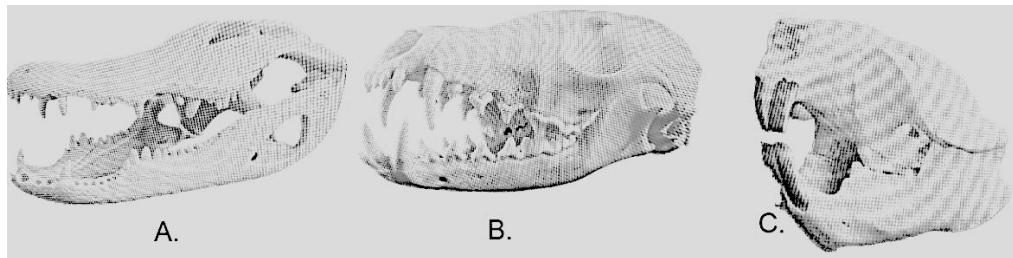
- A. 1
- B. 2
- C. 3
- D. Both 1 and 3

35. Which region of the diagram is showing the transfer of heat energy taking place by radiation?

- A. 1
- B. 2
- C. 3
- D. Both 2 and 3

36. The symbol shown here with the triangles means what?

- A. warm front
- B. cold front
- C. occluded front
- D. stationary front



37. Which of the above skulls is most likely an herbivore?

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

38. Which of the following is specialized vascular tissue in plants?

- A. phloem
- B. xylem
- C. Both A and B
- D. Neither A or B

39. Psoriasis would most affect what body system in humans?

- A. integumentary
- B. circulatory
- C. nervous
- D. skeletal

40. What element is the most abundant gas found in the Earth's atmosphere?

- A. Oxygen
- B. Nitrogen
- C. Hydrogen
- D. Helium

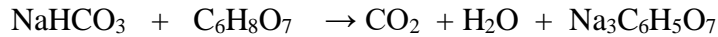
41. A group of islands is called an what?

- A. archipelago
- B. ablation
- C. anticlinal
- D. antipode

42. Which of these show the correct order of eras from most recent to oldest on the Geologic Time Scale?

- A. Paleozoic, Mesozoic, Cenozoic
- B. Cenozoic, Mesozoic, Paleozoic
- C. Mesozoic, Cenozoic, Paleozoic
- D. Paleozoic, Cenozoic, Mesozoic

43. In the chemical equation below, sodium bicarbonate is combined with citric acid to form sodium citrate, water and carbon dioxide.

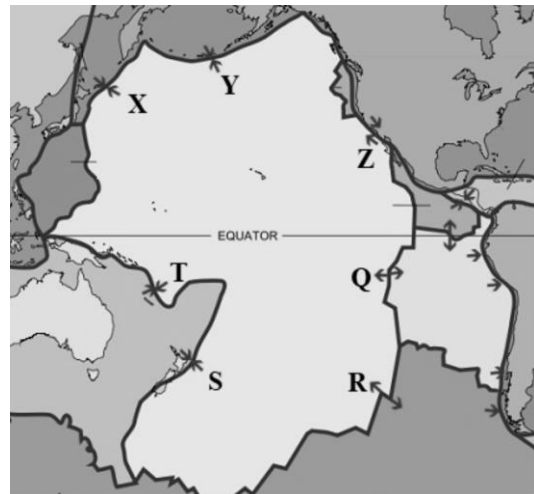


What is a product of this reaction?

- A. sodium bicarbonate
- B. citric acid
- C. carbon dioxide
- D. none of these

44. In the diagram of the tectonic plates shown to the right, which of the boundaries labeled are divergent boundaries?

- A. Z and T
- B. Q and R
- C. X and Y
- D. none



45. Which boundary is a transform boundary?

- A. R
- B. Z
- C. Y
- D. Q

46. In the area on this map outlined by X,Y,Z,Q, T, volcanic activity and earthquakes are more common. This area is known as what?

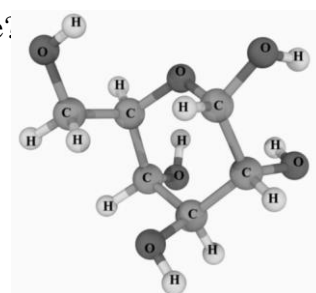
- A. Arabian Circle
- B. Java Trench
- C. Circum-Atlantic Belt
- D. Ring of Fire

47. Fats in living things help to store energy and regulate temperature. Which statement below about fats is true?

- A. Another name for fats is triglycerides.
- B. Fats dissolve easily in water.
- C. Fats are composed of inorganic substances.
- D. Fats store less energy than carbohydrates.

48. Which chemical formula below is correct for this molecule?

- A.  $\text{C}_4\text{O}_8\text{H}_{12}$
- B.  $\text{C}_3\text{O}_3\text{H}_{12}\text{C}_3\text{O}_3$
- C.  $\text{C}_5\text{H}_{12}\text{O}_6$
- D. none of these are correct







**2022 - 2023 TMSCA Middle School Science #12 Test - Key**

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