

**TMSCA MIDDLE SCHOOL
SCIENCE
TEST #13 ©
FEBRUARY 25, 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 - #13

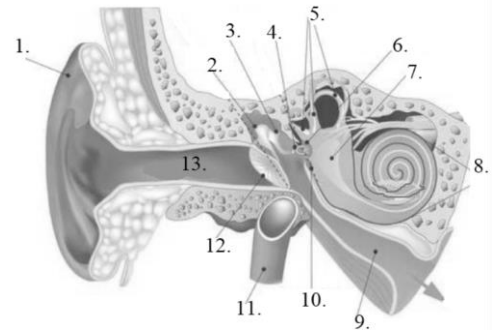
1. Buckminster Fuller, who worked with lattice shell structures, was known in the field of what?
 A. architecture B. chemistry C. physics D. agriculture

2. A geodesic dome is built with what critical geometric shape?
 A. pentagon B. hexagon C. triangle D. circle

3. The mouth, esophagus, stomach, and intestines make up what?
 A. exocrine tract B. lymphatic organs C. gastrointestinal tract D. excretory system

4. A negatively charged ion has more _____ than _____. Fill in the blanks correctly.
 A. protons than electrons
 B. protons than neutrons
 C. neutrons than electrons and protons
 D. electrons than protons

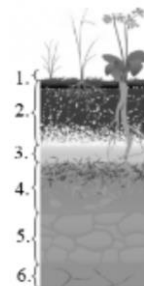
5. Which statement below about magnets and magnetic fields is not true?
 A. A strong magnetic field, such as found in an MRI, has been proven to have healing properties for humans.
 B. MRI stands for Magnetic Resonance Imaging.
 C. Magnetic fields have north and south poles.
 D. Most permanent magnets contain iron, nickel, or cobalt.



6. What part of this diagram of the ear is responsible for maintaining a person's balance?
 A. 5 B. 8 C. 13 D. 1

7. What part of this diagram is known as the eardrum or tympanic membrane?
 A. 1 B. 13 C. 12 D. 11

8. In this soil profile diagram, which layer is called "Bedrock"?
 A. 3
 B. 4
 C. 5
 D. 6



9. What layer is known as the "Zone of Leaching" and falls between the topsoil and the subsoil?
 A. 2 B. 3 C. 4 D. 5

10. What is an “alate” when discussing red harvester ants?
 A. worker ants B. the reproductive ants with wings C. baby ants D. ant larva
11. Bees are found on every continent except for which one?
 A. North America B. Australia C. Antarctica D. Africa
12. There are misconceptions about most native bees that live in North America. Which of these statements below is true?
 A. Honeybees are native to North America.
 B. All types of bees make and store honey.
 C. Most native bees live in the ground.
 D. All bees live in a colony and have a queen.
13. Which statement below about Mars is not true?
 A. Mars has a thin atmosphere made up mostly of Carbon Dioxide.
 B. Mars has five thin rings around it unlike Neptune.
 C. Mars has two identified moons.
 D. Mars is a rocky planet with a surface that has been shaped by wind and volcanic activity.
14. Where is the volcano named “Mauna Loa” located?
 A. Mars B. Washington State C. moon D. Hawaii
15. A widespread and long-lived windstorm that is associated with rapidly moving rain events such as a mesoscale convection system is called what?
 A. derecho B. tsunami C. monsoon D. typhoon
16. Rivers can sometimes help form what?
 A. boundaries between states B. floodplains C. deltas D. all of these
17. When geologists go out in the field, they sometimes lay down a rock hammer next to a rock when they photograph the rock for research. Why do they lay down a rock hammer next to the rock?
 A. in case they need to bust it open
 B. to use the hammer for a size scale reference
 C. for traditional purposes
 D. there is no specific reason



18. Asteroids orbit the sun in our solar system. What influences that orbit?
 A. Jupiter’s gravity
 B. coming close to or impacting another object in space
 C. Sun’s gravity
 D. all of these
19. The farthest point that Earth is from the sun is called what?
 A. aphelion B. perihelion C. apogee D. perigee

20. Which of the following people is known for developing the modern atomic theory and was an expert on color blindness?

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

21. What force opposes motion through a fluid?

- A. drag B. electrical C. inertia D. pressure

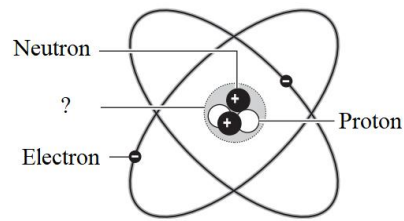
22. What type of engine do you find in an automobile?

- A. fusion engine B. external combustion C. internal combustion D. Both A and B

23. In this model of an atom, there is a missing label with a “?”

What does this represent?

- A. electron cloud
B. proton
C. quark
D. nucleus



24. Oh no! There is a mistake on the labeling of the model. What is the mistake?

- A. The Electron and the Proton labels should be switched.
B. The Neutron and the Proton labels should be switched.
C. The Electron and the Neutron labels should be switched.
D. It is OK as it is. No mistake!

25. These clouds are puffy, fair weather clouds called what?

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



26. Which of the following adaptations is not listed for this thistle cholla, *Opuntia tunicata*?

- A. broad, flat leaves for extra shade
B. stems and leaves with waxy cuticles
C. white, dense spines to reflect sunlight
D. extensive shallow root system



27. Which is not an adaptation that some plants and animals of the desert have?

- A. ability to burrow underground
B. protection such as spines to keep from being eaten
C. enormous number of stomata to keep water from transpiring
D. fat storage such as a camel's hump

28. Randy wants to test several substances to find out if they are acids or bases. He took a red cabbage and boiled it and then took the liquid from the cabbage, put drops in the substances, and used it as an indicator. When the indicator was added, the substance turned to either red or green. Here are his results:

Substance	Red	Green
A	√	
B		√
C		√
D	√	

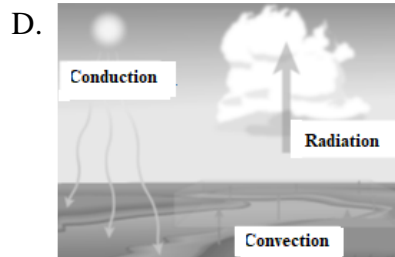
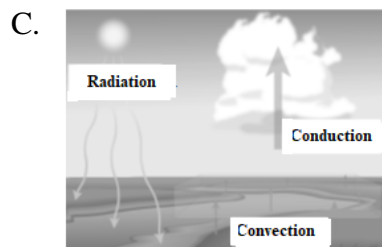
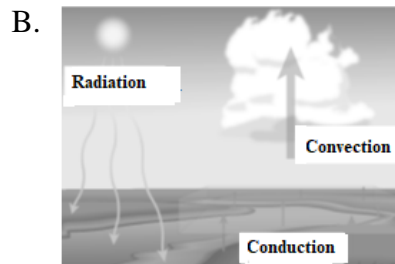
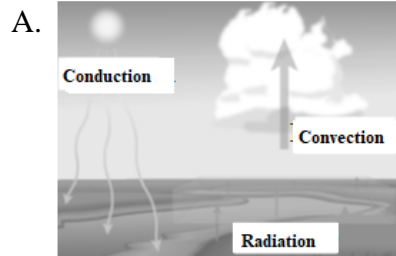
If substance A was vinegar, then which statement below is true about this investigation?

- A. Substance B and C are both acids.
- B. Substance D is an acid.
- C. Substance A is a base and B is an acid.
- D. Substance A, D are both vinegar and B, C are both lemon juice.

29. Some bats can _____ . Fill in the blank correctly.

- A. fly over 100 mph
- B. live over 20 years
- C. feed their pups breast milk
- D. all the above

30. Which diagram below is correctly labeled with the way heat energy is being transferred?



31. The symbol shown here with the semicircles means what?

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



32. Look at this list of items.

plastic dog bowl, crocheted mitten, glass light bulb, metal cup

All of these items are examples of what?

- A. translucent materials
- B. transparent materials
- C. opaque materials
- D. not enough information to tell

33. When identifying minerals, one characteristic to check is “cleavage” of the sample.

What is cleavage in geology?

- A. the length of the cracks in the surface of the mineral
- B. the tendency to break in flat surfaces in either one, two, three or four directions.
- C. the ability of the mineral to scratch a surface
- D. the “shininess” of the material in the sample

34. What role do oceans play in the formation of hurricanes?

- A. The salt in the oceans provides extra energy which aids in hurricane formation.
- B. The oceans have currents that rotate counterclockwise and help with hurricane formation.
- C. Oceans release energy in the force of waves that help fuel hurricanes.
- D. Hurricanes need the energy from the rising warm, moist air over the oceans to form.

35. What tool is used to measure force?

- A. graduated cylinder
- B. electronic protractor
- C. tape measure
- D. spring scale

36. Darian dissolved 100 mg of sugar in 1 liter of warm water. Which is the solute in this event?

- A. sugar
- B. 100 mg
- C. the temperature of the water
- D. water

37. Which of the following is a metalloid?

- A. Boron
- B. Lead
- C. Carbon
- D. Both A and B

38. What are a few common characteristics of a mineral used for identification?

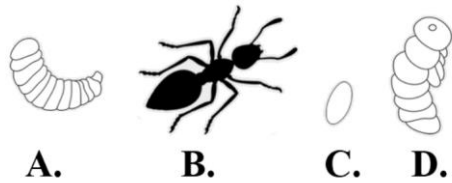
- A. hardness, color, luster, streak
- B. cost, value, rareness, color
- C. weight, mass, crystal, patterns
- D. taste, smell, crushability, combustibility

39. Halley’s, Hale-Bopp, and Hyakutake are all names of what?

- A. comets
- B. stars in the Milky Way Galaxy
- C. nebulae in the near universe
- D. constellations found in the northern sky

40. The lowest point of a wave is called what?
 A. trough B. width C. crest D. perihelion

41.



Which of the following lists are correctly matched with the life cycle of an ant using the diagram and labels seen above?

- A. egg, C, larva, D, pupa A, adult B
 B. egg, A, larva D, pupa C, adult B
 C. egg C, larva A, pupa D, adult B
 D. egg D, larva C, pupa A, adult B

42. How many atoms are in this chemical name? NaHCO_3
 A. 6 B. 7 C. 4 D. 5

43. Different physical forms and atom arrangements in which an element can exist are called what?
 A. ions B. allotropes C. isotopes D. Both A and C

44. Which of the following is an example of a pteridophyte?
 A. fern B. horsetail C. club moss D. all of these

45. During the life cycle of a dragonfly, it will go through stages. Which list belong shows the correct stages?

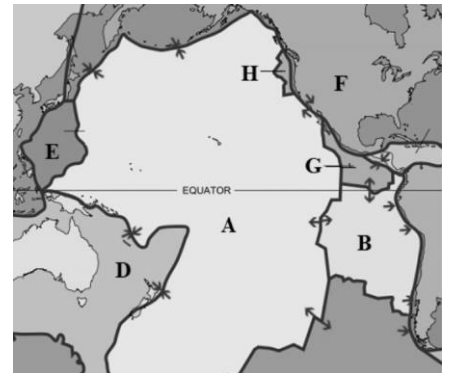
- A. egg, larva, pupa, adult
 B. egg, cocoon, nymph, adult
 C. egg, caterpillar, chrysalis, dragonfly
 D. egg, nymph, adult



46. Which letter on the map to the right represents the Filipino plate?
 A. Plate H B. Plate E C. Plate A D. Plate D

47. Which letter on the map represents the Nazca plate?
 A. Plate A B. Plate B C. Plate H D. Plate D

48. What type of boundary will you find between plate A and B?
 A. convergent boundary
 B. divergent boundary
 C. transform boundary
 D. subordinal boundary



49. Jamaal wanted to find out if a sweet potato would grow “slips” better 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. What is the independent variable in Jamaal’s experiment?

- A. sweet potato or regular potato
- B. peeled or unpeeled sweet potato
- C. number of slips produced
- D. sunlight through the window



50. What is the dependent variable in Jamaal’s experiment?

- A. number of slips produced
- B. amount of sunlight through the window
- C. number of potatoes used
- D. how deep the peel is into the potato skin

2022 - 2023 TMSCA Middle School Science #13 Test - Key

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