TMSCA MIDDLE SCHOOL
SCIENCE
TEST #5©
DECEMBER 3, 2022

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, lnx, 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 ± 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	2A 2											3A 13	4A 14	5A 15	6A 16	7A 17	**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	8B 8	8B 9	8B 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, $g = 9.81$ m/s^2

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

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

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

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

Gram molecular volume at STP = 22.4 liters

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

Absolute zero= 0 K = -273.15°C

Gas constant, R = 1.986 col/K•mole = 0.082 liter•otm/K•mole

One Faraday= 96,500 coulombs (9.65×10^4 C)

Dulong and Petit's constant= 6.0 amu•col/gram•K

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

Atomic mass unit, $m_u = 1.66 \times 10^{-21}$ kg

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

Permittivity of free space $\varepsilon_0 = 8.85 \times 10^{-12}$ C^2/N•m^2

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

1 Atmosphere= 1.02×10^5 N/m^2 = 760 Torr = 760 mmHg

1 Electron Volt - 1.6×10^{-19} Joules

Charge of an electron = -1.6×10^{-19} coulombs (C)

1 horsepower (hp) = 746 W = 550 ft•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 J/g• °C

1. Jessie decided to test the air in the playground at several schools in his town. He built devices that would collect particles from the air (such as dust, pollen, soot, etc.) and placed this device at four elementary school playgrounds. He made sure they would not be disturbed during the 1-week collection period. What would be a reasonable hypothesis for Jessie's investigation?
A. South Elementary has more students than the other elementary schools.
B. East Elementary cares more about air quality than the other schools in the city.
C. North Elementary School playground will have more particles collected from the air than the other school playgrounds because of industrial activity nearby.
D. North Elementary's playground is better than the other playgrounds because of the pond nearby.

After the week was over, he retrieved his devices. His results are shown below in this table.

Playground School Name	Number of particles collected in 1 week
West Elementary	230
East Elementary	103
North Elementary	245
South Elementary	89

2. Which statement would be a factual based conclusion for this investigation?
A. Kids that play at North Elementary playground will have more breathing problems than at the other elementaries.
B. South elementary school playground has a problem with air pollution.
C. The best elementary school playground is South Elementary.
D. The results show that North and West Elementaries had more particles collected with the collection device than at East and South Elementaries.

3. In Jessie's investigation above, what would be considered the independent variable?
A. the time that the device was placed at the playgrounds
B. the number of particles counted on the devices
C. the location the devices were placed
D. none of these

4. Which of the following is a defining feature of a solid?
A. takes on the shape of its container
B. can flow easily
C. keeps its shape and volume
D. its particles in the substance can overcome the attraction between them

5. The temperature at which a gas becomes a liquid is called what?
A. freezing point   B. condensation point   C. melting point   D. boiling point

6. Janice wanted to make musical instruments out of a set of 4 glass bottles. She lined them up in a row and added water in different amounts to each of the bottles as shown. To make a sound, she blew across the top of the bottles. Out of these bottles, which bottle produced the lowest note?
A. 1
B. 2
C. 3
D. 4

new moon   full moon
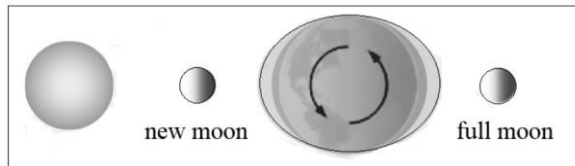
7. What tide is taking place with the placement of the sun, Earth, and moon in this diagram?
A. neap tide
B. spring tide
C. Earth tide
D. This is the no tide period of the cycle.

8. Using the chemical formula, how many elements make up baking soda? $NaHCO_3$
A. 4   B. 5   C. 3   D. 2

9. Each spring, the town has an outdoor concert. Jeff's house is about 100 meters from the park where the concert takes place. If Jeff was sitting in his back yard and the conditions are right, would he most likely hear the music from the concert sooner on a warm day or cold day?
A. the music will not travel 100 meters
B. Cold day - sound travels faster through cold air
C. Warm day - sound travels faster through warm air
D. sound travels the same, temperature does not matter

10. While observing the trophic levels and the energy relationships, about what percentage of energy is passed from producers to primary consumers?
A. 90%   B. 50%   C. 25%   D. 10%

11. When a baby duckling hatched, the first living organism it saw was a person. The baby started following her around everywhere. The duck's mother was nowhere to be found. This baby may have a difficult time surviving in the wild. Why?
A. innate behaviors will not develop normally
B. instinct will not be learned from a duckling's mother
C. imprinting on a human can prevent learning survival skills
D. humans germs will infect the baby duckling

12. Which of the following scientists was credited for discovering penicillin - one of the first true antibiotics?
A. Newton   B. Oersted   C. Fleming   D. Goddard

13. Which of the following is a difference between plant and animal cells?
A. Animal cells have lysosomes, but plant cells do not.
B. Chlorophyll is found in animal cells, but not plant cells.
C. Plant cells have cell membranes, but animal cells do not.
D. A large central vacuole is found in plant cells, but not animal cells.

14. Using this diagram of the mouth, what part is labeled with letter D?
A. canine
B. molars
C. uvala
D. incisors
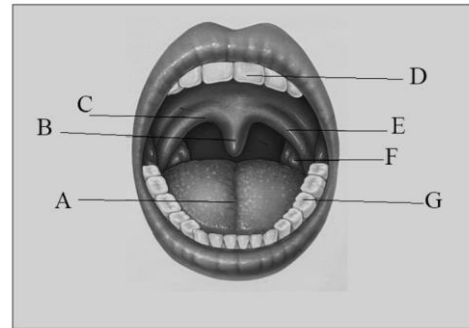
15. The part of the diagram labeled letter F is believed to have the job of preventing infection, but sometimes gets infected itself. What is it?
A. tongue
B. palatine tonsils
C. palatoglossal arch
D. uvala

16. What type of stream continuously flows throughout the year?
A. annual   B. intermittent   C. perennial   D. ephemeral

17. Organisms that obtain energy directly from autotrophs are called what?
A. primary consumers   B. tertiary consumers   C. detritivores   D. secondary consumers

18. What dos the prefix "neo" mean?
A. old   B. medium   C. new   D. difficult

19. Which correctly shows the hierarchical order of organization of life in an ecosystem?
A. community, organism, population
B. organism, community, population
C. organism, population, community
D. population, community, organism

20. Which statement about cells is not true?
A. All cells have membrane bound structures called organelles.
B. New cells come from pre-existing cells.
C. Cells are the basic unit of life.
D. Living organisms can be composed of one or more cells.

21. Which of the following are abiotic factors that organisms might compete for to survive?
A. bacteria and viruses
B. rocks and insects
C. soil and plants
D. light and water

22. A qualified scientist did a demonstration for a class. She took a container of liquid nitrogen and a container of hot water and combined them by tossing them up into the air. A white cloud formed above her head. What statement below is true about this demonstration?
A. The liquid nitrogen contained water droplets that were warmed by the hot water giving off smoke.
B. When liquid nitrogen mixes with water, a chemical reaction takes place giving off smoke.
C. The hot water mixed with the liquid nitrogen forming ice crystals that formed a cloud as they melted and condensed.
D. The cloud formed because the water vapor coming from the hot water was cooled rapidly by the liquid nitrogen which caused immediate visible condensation in the air.

23. When atoms of the same element have different numbers of neutrons this is called what?
A. impossible   B. isotopes   C. ions   D. electron cloud theory

24. Who proposed in 1911 the theory that atoms have a dense, positively charged nucleus surrounded by electrons?
A. J.J. Thomson   B. Ernest Rutherford   C. John Dalton   D. Niels Bohr

25. Sodium Chloride (NaCl) is common table salt. What would it be classified as?
A. mixture   B. compound   C. covalent bond   D. solution

26. If a geologist adds drops of hydrochloric acid to a rock and the rock contains calcium carbonate, what will happen?
A. the rock will change color to red
B. the rock will crack along the line of acid
C. bubbles of carbon dioxide will form
D. nothing will happen because geologists use nitric acid, not hydrochloric acid to test rocks

27. Beatrice has a mineral that can scratch talc, gypsum, and calcite but cannot scratch fluorite or apatite.
What would its relative hardness be?
A. between 3 and 4
B. between 4 and 5
C. between 2 and 3
D. between 1 and 2

Mineral	Mohs relative Hardness
Talc	1
Gypsum	2
Calcite	3
Fluorite	4
Apatite	5
Orthoclase	6
Quartz	7
Topaz	8
Corundum	9
Diamond	10

28. Most of the weather takes place in this layer of the atmosphere. What is it?
A. ionosphere   B. stratosphere   C. exosphere   D. troposphere

29. Tina was working on an investigation to see the effect of water vapor in the air and sinus infections in her community.
What instrument would Tina use to measure the amount of water vapor in the air?
A. hydrometer   B. barometer   C. anemometer   D. hygrometer

30. Margaret used the symbol MG to stand for Magnesium. Her teacher marked it wrong. Why is Margaret incorrect?
A. MG is the symbol for Manganese not Magnesium.
B. M is the symbol for Magnesium not MG.
C. She capitalized the second letter, and it should be "g".
D. Both A and C are correct.

31. Which statement about forces below is true?
A. When the net force of an object is equal to zero then it is unbalanced.
B. When the net force on an object is greater than zero then it is unbalanced.
C. Balanced forces have no effect on an object.
D. Balanced forces produce change in the motion of an object.

32. In science class, the students were dissecting a fish. Just above the stomach, they found an organ that is an elongated sac. What organ would this be?
A. swim bladder   B. operculum   C. heart   D. gall bladder

33. Most amphibians can take in oxygen through their moist skin. This is called what?
A. septum respiration
B. cutaneous respiration
C. tympanic membrane
D. pulmonary circulation

34. What statement below about a shark's skeleton is true?
A. It is very dense.
B. It is rigid and non-flexible.
C. It is composed of cartilage.
D. It is made of hollow bone.
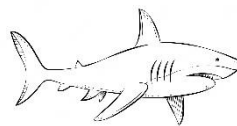
35. If an insect has siphoning mouth parts (adult), chewing mouthparts (larvae), undergoes complete metamorphosis, and the adults have two pairs of wings covered with scales, then it most likely belongs to what Order?
A. Lepidoptera   B. Hymenoptera   C. Diptera   D. none of these

36. "Beetles" are to Order Coleoptera as "what" is to Order Diptera?
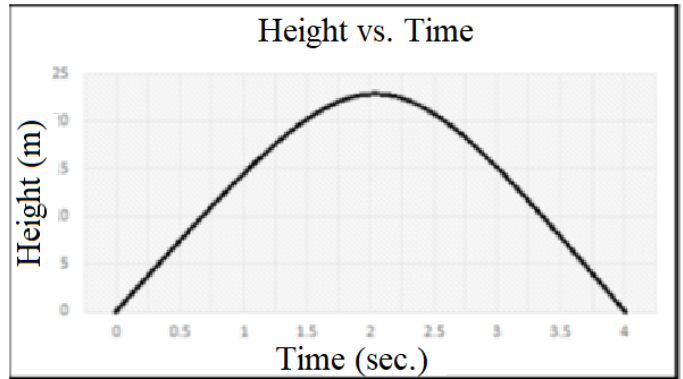A. butterflies   B. bees   C. ants   D. flies

37. Which time period on the Geologic Time Scale would include having large areas of land and water, seed ferns, coniferous plants, and the first land dwelling reptiles?
A. Quaternary Period
B. Ordovician Period
C. Cambrian Period
D. Permian Period

38. At times, animal and plant traits are influenced by factors in the environment such as temperature, daylight hours, soil pH, or the nutrition from foods that are eaten. Which trait below would not be one of these types of traits?
A. nose shape of a human
B. weight of a baby
C. the height a plant will grow
D. fur color of a snowshoe hare

39. What are the small bristles that Earthworms use for movement?
A. setae   B. annuli   C. castings   D. clitellum

40. The prefix "chrono" means what?
A. old   B. time   C. ancient   D. down

41. Biomass from dead plants and microorganisms, both terrestrial and marine life deposits, underwent great pressure and high temperatures as they were buried deep below the surface of the Earth. After millions of years, these organic remains were converted to what?
A. coal, oil, natural gas
B. only oil
C. minerals
D. aquifers

42. What light emitting object is the driving factor of Earth's climate?
A. bioluminescence   B. trees   C. sun   D. ultraviolet minerals

43. What element has an atomic number of 12?
A. Mg   B. Mn   C. C   D. none of these

44. Which of the following is a synthetic greenhouse gas?
A. carbon dioxide   B. methane   C. fluorinated gas   D. water vapor

45. The name given to the phenomenon in which the ocean water on the surface near the equator and eastern and central Pacific warms which may cause unusual weather events in North America is called what?
A. El Bambino   B. La Nína   C. Los Amigos   D. El Níno

46. A prolonged dormancy period for some animals during hot and dry conditions is called what?
A. migration   B. eutrophication   C. cactus   D. estivation
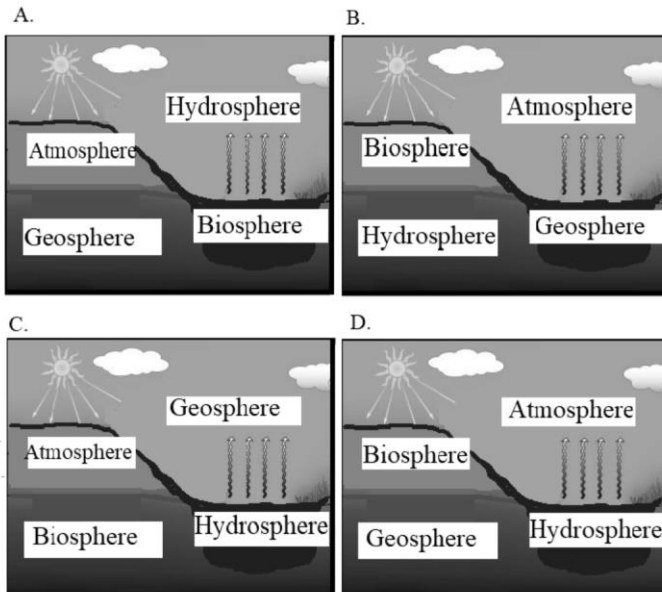
47. A "lotic" system includes which of the following?
A. ponds, lakes, oceans
B. canyons, buttes, mesas
C. rivers, creeks, and streams
D. plains, mountains, hills

48. Which statement describes what event took place represented by this graph?

A. a ball rolled down a ramp
B. a ball dropped from a 2nd story window
C. a ball when tossed in the air
D. a ball thrown horizontally to another person

Height vs. Time

49. Which diagram below is correctly labeled?

A.

Hydrosphere
Atmosphere
Geosphere
Biosphere

B.

Atmosphere
Biosphere
Hydrosphere
Geosphere

C.

Geosphere
Atmosphere
Biosphere
Hydrosphere

D.

Atmosphere
Biosphere
Geosphere
Hydrosphere

50. Ross was printing objects on his 3D printer. He knows the mass and volume of the materials he is using. How can he find the density of an object that he prints?
A. Take the volume measurement and divide by the mass of the object
B. Take the mass measurement of the object and divide it by the volume
C. Take the mass measurement of the object and multiply by the volume
D. Take the volume measurement and multiply by the mass of the object

2022 - 2023 TMSCA Middle School Science #5 Test - Key

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