TMSCA MIDDLE SCHOOL
SCIENCE
REGIONAL TEST ©
MARCH 7, 2020

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 formulas 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.

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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**	**9**	**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 al 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 x 10^4 C)

Dulong and Pelil's constant= 6.0 amu•cal/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 on electron"' -1.6×10^{-19} coulombs (C)

1 horsepower (hp) = 746 W = 550 ft•lb/s

Neutron Moss= 1.008665 au

Proton Mass= 1.007277 au

1 au= 931.5 MeV

1 calorie= 4.184 Joules (J)

Specific heal of water= 4.18 J/g• °C

1. In science lab, the students were conducting an experiment with the surface tension of water. They filled (to the rim) 4 small beakers with the following: room temperature water, hot tap water, room temperature water with 5 drops of detergent, and hot tap water with 5 drops of detergent. Next, they carefully added paper clips to the beakers, one at a time, and recorded how many paper clips they could add before the water overflowed the container. The chart below shows the results.

    Which statement below about the investigation is true?

Beaker	Number of Paper Clips Added
A – room temp. water	63
B – hot tap water	26
C – room temp. water with 5 drops of detergent	12
D – hot tap water with 5 drops of detergent	9

    A. The independent variable would be the number of paper clips each could hold before spilling.
    B. The dependent variable would be the temperature of the water.
    C. The dependent variable would the number of detergent drops added to the water.
    D. The independent variable would be the water treatment (temperature, detergent or not)

2. What would be a reasonable conclusion to this investigation?
    A. The containers with detergent had fewer paper clips overall because the surface tension of the water was the strongest.
    B. The room temperature water with no detergent had the most paperclips because the surface tension of the water was strongest.
    C. The hot tap water with detergent had the least paperclips because the surface temperature of this water was the strongest.
    D. The room temperature water with no detergent had the most paperclips because the temperature of the water was strongest.

3. While conducting this investigation, the students noticed that they needed to do which of the following to make the experiment fair?
    A. dry the paperclips between the tests if they used the same paperclips
    B. conduct the hot tap water investigations quickly so the water temperature did not decrease too much
    C. Both A and B
    D. add two paperclips at a time because it took way too long when adding one

4. Which of the following should be done with this investigation to make sure that it had reliable data?
    A. have different people do each job for each beaker
    B. estimate the number of paper clips in each beaker
    C. use different paper clips sizes
    D. repeat the investigation at least 3 times

5. If a water droplet is in a zero-gravity environment, it will take the shape of a what?
   A. cylinder   B. teardrop   C. sphere   D. no shape at all

6. What type of stream flows continuously throughout the year and are most likely fed by springs or a groundwater discharge area?
   A. ephemeral   B. intermittent   C. perennial   D. Both A and B

7. A chemical that helps a chemical reaction happen more easily and quickly without actually being part of the reaction as a reactant or product is called what?
   A. activator   B. isotope   C. allotrope   D. catalyst

8. What does the prefix "micro" mean?
   A. large   B. small   C. same   D. shape

9. An object's electrical resistance depends on which of the following?
   A. material, density, color, and length
   B. height, weight, mass
   C. material, thickness, length, and temperature
   D. color, depth, mass, temperature

10. Organisms that obtain their energy directly from autotrophs are called what?
   A. primary consumers   B. herbivores   C. detritivores   D. Both A and B

11. Organisms that obtain their energy from herbivores are known as what?
   A. secondary consumers
   B. detritivores
   C. producers
   D. secondary carnivores

12. How many elements make up baking soda? $NaHCO_3$
   A. 6   B. 3   C. 5   D. 4

13. What is necessary for evaporation of water to occur?
   A. repulsive forces
   B. conduction
   C. negative charges
   D. heat energy

14. Monarch butterflies contain a toxic chemical which is a cardenolide. What can these chemicals do if ingested by a monarch predator?
   A. destroy liver cells
   B. interfere with the work of the lungs
   C. nothing, they are basically harmless
   D. affect the function of the heart

15. About how much of the Earth's water is considered available for human use?
    A. about 50%   B. 97%   C. 3%   D. <1 %

16. How many valence electrons does an oxygen atom contain?
    A. 2   B. 8   C. 6   D. 0

17. Streams, creeks, and rivers are all part of what type of system?
    A. lotic   B. lentic   C. intermittent   D. oligotrophic

18. Recently research has been done "in fimo". What does this research term mean?
    A. research inside an automobile
    B. research done free of charge
    C. study is being done on the feces of an organism
    D. study is taking place under water

19. According to the Red Cross, this blood type is found in 1% or less of the people?
    A. O-
    B. O+
    C. A+
    D. AB-

20. A chemical reaction in which a substance gains one or more electrons is called what?
    (is paired with another reaction in which the electron(s) are lost)
    A. oxidation   B. reduction   C. condensation   D. precipitation

21. Which of the following would be found in the pancreas?
    A. Islets of Langerhans
    B. periosteum
    C. Haversian canal
    D. sinoatrial node

22. The root word "pulmo" is related to what organ in the body?
    A. heart   B. lung   C. kidney   D. liver

23. Some plants will grow on another plant for support but do not take any water or nutrients from the plant. These plants which get their water from rain or water vapor in the air are called what?
    A. mesophytes   B. epiphytes   C. xerophyte   D. parasite

24. The NOAA organization is an important scientific agency. What does NOAA stand for?
    A. Nationwide Organization of Atlantic Association
    B. National Oceanic and Atmospheric Administration
    C. Nutritional Organization of American Astronauts
    D. Nightly Observers of Ants Association

25. The 100-member marching band was practicing for their half-time show at the field about 500 yards from the school. If a person was sitting at the school and the conditions are right, would he/she most likely hear the band sooner on a warm day or cold day?
    A. the sound from the band will not travel 500 yards
    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

26. Which term below involves the number of constituent particles to one mole of a substance?
    A. Planck's constant
    B. Boltzmann's constant
    C. Avogadro's number
    D. Dulong and Petit's constant

27. Gastric acid has a pH of 1.5 to 3.5 on the scale. This makes it a what?
    A. strong acid   B. weak acid   C. strong base   D. neutral

28. What element is most abundant in the Earth's crust?
    A. Nitrogen   B. Oxygen   C. Phosphorus   D. Carbon

29. Fred was tardy to physics class. When he sat down, he heard the teacher say "and that is how magnetism and electricity are related to each other". Most likely, the teacher was talking about what?
    A. Newton's laws
    B. Planck's constant
    C. Bohr's model
    D. Maxwell's equations

30. Which of the following is the outer layer of the skin that includes the sense organs?
    A. outederm   B. ectoderm   C. endoderm   D. mesoderm

31. Which statement below is incorrect when discussing mutations?
    A. Mutation rates in nature are very slow.
    B. Mutation is a source of variation in organisms.
    C. Mutation makes evolution possible.
    D. Mutations all result in phenotypic changes.

32. Sometimes on a cool morning, dew collects on a spider web. This is an example of what?
    A. evaporation   B. sublimation   C. transpiration   D. condensation

33. Electrical circuits need an energy source, wires, and a load. Which of the following would be considered a "load"?
    A. a photocell   B. a battery   C. a light bulb   D. a copper wire

34. Tinea pedis is caused by a what?
     A. bacteria   B. virus   C. vaccine   D. fungus

35. The chickenpox disease is caused by what?
     A. bacteria   B. Varicella-zoster virus   C. RSV   D. Rubeola

36. Which of the following shows the correct order from smallest to largest?
     A. cell, organelle, tissue, system, organ, organism
     B. organelle, tissue, cell, organ, system, organism
     C. cell, tissue, organelle, organ, system, organism
     D. organelle, cell, tissue, organ, system, organism

37. Which statement below is a benefit offered by bats?
     A. bats help to pollinate many species of plants
     B. bats eat harmful insects to agricultural crops, such as corn
     C. bats support the cave ecosystem and a diversity of organisms
     D. all of these

38. Kinetic energy depends on what two factors?
     A. mass and volume
     B. speed and mass
     C. weight and height
     D. speed and weight

39. Which of these would be the best definition of energy?
     A. the ability to do work
     B. the transfer of work
     C. flow of small particles in space
     D. electricity

40. An area where fresh water from a river flows to the salty water of an ocean is called a what?
     A. estuary   B. bay   C. lagoon   D. all of these

41. What type of stream only flows in direct response to precipitation and may be dry for many parts of the year? (they have no spring or continuous surface water source)
     A. ephemeral   B. intermittent   C. perennial   D. Both A and C

42. What exactly is the "smoke" leaving the top of the nuclear plant towers?
     A.   It is actual smoke from the burning reaction taking place.
     B.   It is toxic emissions being filtered before being released.
     C.   It is water droplets that condensed from water vapor while cooling.
     D.   It is radiated steam that is released from the process.
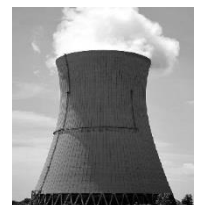
43. Chris's class was creating genetic "monsters" to show how some traits are dominant and recessive. He tossed a coin to determine the traits of his creation. His monster was homozygous recessive for skin color. (G for green dominant, g for purple recessive). Also his monster turned out to be heterozygous dominant for eye shape. (L for large eyes, l for small eyes) Which phenotype below would match Chris's monster?
    A. GG, Ll
    B. gg, Ll
    C. purple skin, large eyes
    D. green skin, small eyes

44. A corn farmer and a traveler had a discussion in a local diner. The traveler was saying how he hates bats. He said they carry diseases and smell bad. The farmer disagreed and explained to the traveler why. Which argument below is most likely a fact the farmer mentioned?
    A. Bats eat egg-laden corn earworm moths that help prevent infestations
    B. Pesticides cost more than $70 an acre to apply to prevent corn earworms.
    C. Bats can develop white-nose syndrome which prevents their over-population
    D. Both A and B

45. What type of circuit consists of a circuit in which each load is placed on a separate branch and the charges can go through more than one path?
    A. series   B. electrical stationary   C. Both A and B   D. parallel

46. What type of air mass would form over the snow-covered regions of northern Canada?
    A. Maritime tropical
    B. Maritime polar
    C. Continental tropical
    D. Continental polar

47. In chemistry, a mole is a what?
    A. The amount of substance containing the same number of chemical units as exactly 15 grams of Carbon 15.
    B. The SI base unit for measuring an amount of a substance.
    C. Is equal to 6.02×10^{32}
    D. an electrically charged particle with a specific mass

48. What bone is also known as the "shinbone"?
    A. fibula   B. tibia   C. navicular   D. hyoid

49. A soccer player kicked the ball a distance of 75m. She used a force of 15 N. Calculate the work done on the ball by the soccer player.
    A. 5 Joules
    B. 1050 Joules
    C. 0 Joules
    D. 1125 Joules

50. Which of the below statements are examples of how Pascal's principle can be used in real life?
    A. the hydraulic breaks in an automobile
    B. cartesian diver experiment
    C. using a cue ball to hit another ball on a pool table
    D. drinking through a straw

2019 - 2020 TMSCA Middle School Science Test- Regional - Key

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