T M S C A M I D D L E S C H O O L

S C I E N C E

R E G I O N A L T E S T ©

M A R C H 3 , 2 0 1 8

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.

Periodic Table of the Elements

1A 1												3A 13	4A 14	5A 15	6A 16	7A 17	8A 18
1 H 1.008	2A 2																2 He 4.003
3 Li 6.941	4 Be 9.012											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 65.41	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 138.91	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 (272)	112 Cn (285)						

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
90 Th 232.04	91 Pa 231.04	92 U 238.03	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 x 10^{23} molecules/mole
Planck's constant, h = 6.63 x 10^{-34} J•s
Planck's reduced constant, $\hbar = h/2\pi$ = 1.05 X 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 x 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•col/gram•K
Electron rest mass, m_e = 9.11 x 10^{-31} kg
Atomic mass unit, m_u = 1.66 x 10^{-21} kg
Boltzmann constant, k_B = 1.38 x 10^{-23} J/K
Permittivity of free space ε_0 = 8.85 x 10^{-12} C^2/N•m^2
Permeability of free space $\mu_0 = 4\pi$ x 10^{-7} T •m/A
1 Atmosphere= 1.02 x 10^5 N/m^2 = 760 Torr = 760 mmHg
1 Electron Volt - 1.6 x 10^{-19} Joules
Charge of on electron"' -1.6 x 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

2017-2018 TMSCA Middle School Science Regional Qualifying Test

1. During what phase of mitosis will the spindle fibers attach to the chromosomes?
A) prometaphase **B)** interphase **C)** anaphase **D)** telophase

2. A somatic human cell has
A) 23 chromosomes.
B) 46 chromosomes.
C) 46 pairs of chromosomes.
D) 21 pairs of chromosomes.

3. Which of the following is correctly matched with its function?
A) lysosome: contains genetic material
B) mitochondria: generates lipids
C) rough ER: creates ATP
D) Golgi body: packages proteins

4. The inner portion of the cell membrane would appropriately be described as
A) polar. **B)** nonpolar. **C)** hydrophilic. **D)** ionic.

5. A freshwater organism was placed into a saltwater environment. What would happen to the organism?
A) It would shrivel.
B) It would swell.
C) It would thrive in the environment.
D) It would be able to move water equal in and out of the cell.

6. An organism that has different alleles for the same trait would be referred to as
A) homozygous. **B)** heterozygous. **C)** hemizygous. **D)** none of the above.

7. A homozygous dominant black guinea pig and homozygous recessive white guinea pig are crossed. What is the probabilty of their offspring's phenotype?
A) 75% black and 25% grey
B) 75% black and 25% white
C) 50% black and 50% white
D) 100% black

8. Which of the following is not a type of evolutionary evidence?
A) transition fossils
B) homologous structures
C) embryology
D) analogous structures

9. When clear cutting takes place on a farm, what would happen afterwards?
A) primary succession.
B) secondary succession.
C) climax community.
D) ecosystem.

10. A relationship where an organism benefits from one organism while the other organism also benefits is known as
A) parasitism. **B)** commensalism. **C)** amensalism. **D)** mutualism.

11. Which of the following would you find in a virus?
A) genetic material **B)** cell wall **C)** phospholipid bilayer **D)** nucleus

12. Which of the following would be an appropriate organization of plants from earliest to most recent development?

A) moss → ferns → algae → dicots
B) dicots → ferns → moss → algae
C) ferns → angiosperms → moss → dicots
D) algae → moss → ferns → angiosperms

13. Fully-grown adults are much larger in size than young children. What happens to the cells of the body during the growth of a child?

A) The cells of a growing child divide to make more cells, and those cells are each half the size as the cells were before they divided. The cells do not grow before they divide again.
B) The cells of the body of a growing child grow, but the number of cells stays the same.
C) The cells of a growing child divide to make more cells, and those cells grow to become the same size as the cells were just before they divided.
D) The size and number of cells in the body of a growing child stay the same.

14. A group of students is making paper airplanes. They think that the kind of paper and the design of the airplane may affect how far each paper airplane flies. The students first test if the kind of paper affects how far the airplane flies. They make several airplanes out of different kinds of paper, using the same design. Why is it important that all the airplanes have the same design?

A) By using the same design, the students can learn about both the effect of the design and the effect of the paper
B) By using the same design, the students can learn about the effect of the design.
C) If they do not use the same design, the students cannot learn about the effect of the paper.
D) It is NOT important for the airplanes to have the same design because the students are not testing the effect of the design.

15. Which of the following does DNA provide information for?

A) Both the types of amino acids that make up a protein, and the sequence of those amino acids.
B) The types of amino acids that make up a protein molecule, but not the sequence of amino acids.
C) The sequence of amino acids that make up a protein molecule, but not the types of amino acids.
D) Neither the types of amino acids that make up a protein, nor the sequence of those amino acids.

16. What do DNA and protein have to do with each other?

A) DNA is a type of protein
B) Proteins make up DNA
C) DNA carries the information to create proteins
D) None of the above

17. How many nucleotides are needed to code for two amino acids?

A) 2 **B)** 6 **C)** 9 **D)** 4

18. Which of the following contain hereditary information?

A) Chromosomes **B)** Genes **C)** Plasmids **D)** All of the above

19. Which of the following statements about competition between animals is TRUE?

A) Animals compete for food when it is limited, but they do not compete for water when it is limited.
B) Animals compete for food and water when they are limited, but they do not compete for shelter when it is limited.
C) Animals compete for food, water, and shelter when they are limited.
D) Animals do not compete for any resources, even when it is limited.

20. A cook places an iron frying pan on the stove. What happens as the iron pan heats up?

A) The number of iron atoms increases, so the pan gets a tiny bit larger.
B) The number of iron atoms does not change, so the pan remains the same.
C) The distance between the iron atoms increases, so the pan gets a tiny bit larger.
D) The distance between the iron atoms does not change, so the pan remains the same.

21. When water boils, bubbles rise to the surface of the water. What are the bubbles made of?

A) Air molecules
B) Heat molecules
C) Water molecules
D) Oxygen molecules

22. Which of the following is the smallest?

A) A germ
B) An atom
C) The width of a hair
D) A cell in your body

23. Which of the following is an example of a chemical reaction?

A) A piece of wax melting and forming a liquid
B) A piece of chalk making white marks on a chalkboard
C) Bubbles of gas forming when a seashell is placed in vinegar
D) A powder dissolving in hot water to make hot chocolate

24. A student holds a ball at the top of a ramp. He lets go of the ball and the ball speeds up as it rolls down the ramp. How do the gravitational potential energy and the motion energy (kinetic energy) of the ball change as the ball rolls down the ramp? Why?

A) The gravitational potential energy decreases and the motion energy increases. The gravitational potential energy is transformed into motion energy as the ball rolls down the ramp.
B) The gravitational potential energy decreases and the motion energy increases. As soon as the ball starts moving it no longer has gravitational potential energy; it has only motion energy.
C) The motion energy and gravitational potential energy both decrease. Both forms of energy are used up as the ball moves and are not transformed into any other form of energy.
D) The gravitational potential energy and the motion energy both stay the same. One form of energy cannot be transformed into a different form of energy.

25. A classic example of a longitudinal wave found in nature is a

A) light wave. **B)** sound wave. **C)** ocean wave. **D)** Tsunami wave.

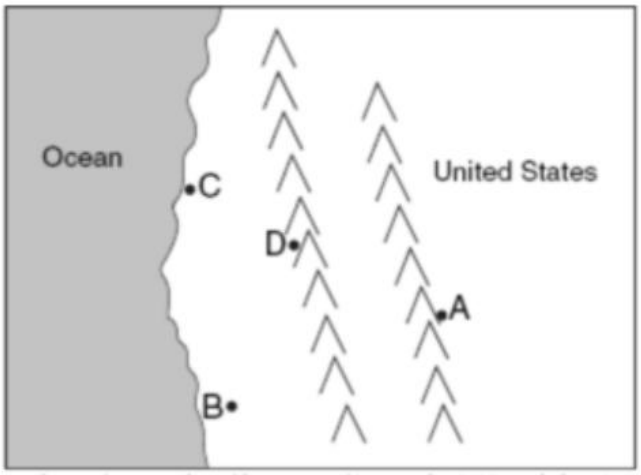
26. What tectonic plate is London, England part of?

A) Eurasian **B)** North American **C)** Scotia **D)** None of the above

27. What color do the hottest stars appear to be?

A) bluish white **B)** yellow **C)** red **D)** green

28. The map below shows the location of 4 cities, A, B, C, and D in the western United States where prevailing winds are from the southwest.



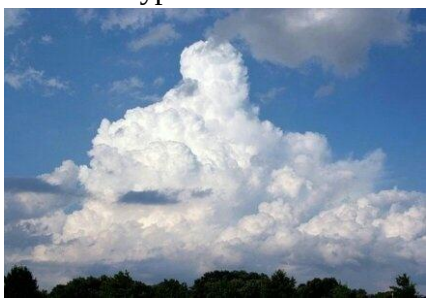
Which city on the map is located in a rainshadow?

A) A **B)** B **C)** C **D)** D

29. What is a tornado-like event that forms over water?

A) mesocyclone **B)** microburst **C)** supercell **D)** waterspout

30. What type of cloud would the following be?



A) cirrus **B)** cumulonimbus **C)** stratus **D)** shelf

31. Which of the particles below are considered an ion?

A) Cl^- **B)** Ar **C)** F_2 **D)** Ag

32. Which term is defined as a measure of the average kinetic energy of the particles in a sample?
A) temperature **C)** pressure
B) thermal energy **D)** chemical energy

33. Which Kelvin temperature is equivalent to 56°C?
A) -329 K **B)** -217 K **C)** 217 K **D)** 329 K

34. Which quantity of heat is equal to 200. joules?
A) 2.00 kJ **B)** 20.0 kJ **C)** 200. kJ **D)** 0.200 kJ

35. Which element is a member of the halogen family?
A) K **B)** Ar **C)** Cl **D)** S

36. The elements known as alkaline earth metals are found in Group
A) 1 **B)** 2 **C)** 17 **D)** 18

37. The prefix *inter-* used in science to form words such as intermembrane means?
A) between **B)** against **C)** within **D)** turgid

38. A unit by which velocity is measured would be?
A) m/s **B)** meter **C)** kilogram **D)** Watt

39. How many hydrogen atoms are found in hydrogen peroxide, H_2O_2?
A) 2 **B)** 4 **C)** 1 **D)** 0

40. What type of rock can turn into metamorphic rock?
A) sedimentary rock **C)** only metamorphic rock
B) igneous rock **D)** any type of rock

41. A 10 kilogram mass rests on a horizontal frictionless surface. A horizontal force of 5 Newtons is applied to the mass. After the force has been applied for 1 second, the velocity of the mass is:
A) 0 meters per second **C)** 5 meters per second
B) 0.5 meters per second **D)** 50 meters per second

42. Kinetic energy is energy of:
A) position **B)** radiation **C)** motion **D)** formation

43. Which of the following does NOT travel in a vacuum?
A) radio waves **B)** gamma rays **C)** magnetic waves **D)** sound waves

44. Isotopes of an element have different numbers of:
A) electrons **B)** protons **C)** neutrons **D)** leptons

45. Meiosis creates how many daughter cells?
A) 2 **B)** 3 **C)** 4 **D)** 1

46. What process is not part of the carbon cycle?

A) Weathering
B) Cellular respiration
C) Combustion
D) Assimilation

47. The arrow in a food chain represents

A) The flow of matter
B) The flow of heat
C) The transfer of energy
D) The transfer of biomass

48. What kind of tides exist at tidal bulges?

A) High **B)** Low **C)** Neap **D)** Spring

49. Which of the following reactions would be a synthesis equation?

A) $2H_2O \rightarrow 2H_2 + O_2$
B) $2H_2O_2 \rightarrow 2H_2O + O_2$
C) $N_2 + 3H_2 \rightarrow 2NH_3$
D) $2HgO \rightarrow 2Hg + O_2$

50. The prefix *hemo-* used in science to form words such as hemoglobin means?

A) blood **B)** tissue **C)** cell **D)** iron

2017-2018 TMSCA Middle School Science Regional Qualifying Test

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