

TMSCA MIDDLE SCHOOL SCIENCE STATE TEST © APRIL 21, 2018

GENERAL DIRECTIONS

- About this test:
 - You will be given 40 minutes to take this test.
 - There are 50 problems on this test.
- 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.
- If using a Scantron answer form, be sure to correctly denote the number of problems not attempted.
- You may write anywhere on the test itself. You must write only answers on the answer sheet.
- You may use additional scratch paper provided by the contest director.
- All problems have **ONE** and **ONLY ONE** correct [BEST] answer. There is a penalty for all incorrect answers.
- 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.
- A simple scientific calculator with the following formulas 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.**
- All answers within $\pm 5\%$ will be considered correct.
- 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.
- In case of ties, percent accuracy will be used as a tie breaker.

Periodic Table of the Elements

1A 1 1 H 1.01	2A 2 4 He 4.00											3A 13 5 B 10.81	4A 14 6 C 12.01	5A 15 7 N 14.01	6A 16 8 O 16.00	7A 17 9 F 19.00	8A 18 10 Ne 20.18
3 Li 6.94	4 Be 9.01											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
11 Na 22.99	12 Mg 24.31	3B 3 21 Sc 44.96	4B 4 22 Ti 47.87	5B 5 23 V 50.94	6B 6 24 Cr 52.00	7B 7 25 Mn 54.94	8 26 Fe 55.85	9 27 Co 58.93	10 28 Ni 58.69	11 29 Cu 63.55	12 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
19 K 39.10	20 Ca 40.08	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, $N = 6.02 \times 10^{23} \text{ molecules/mole}$

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 Pelil'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 = $4.18 \text{ J/g}\cdot^\circ\text{C}$

2017-2018 TMSCA Middle School Science State Meet

1. How many protons are found in a single atom of helium?
A) 2 B) 3 C) 1 D) 0
2. A weather forecast of 100% relative humidity suggests an increased possibility of:
A) rain B) wind C) drying conditions D) rising temperatures
3. What color would you see if red was reflected and all others were absorbed by a material?
A) green B) red C) yellow D) blue
4. Which of the following is the closest synonym for motile:
A) having a motor C) able to move
B) using energy D) living in water
5. Which of the following terms is used by microbiologists for a bacterium with a rod shape:
A) coccus B) bacillus C) spirilla D) cylindrical
6. Which of the following is not a vertebrate?
A) cnidarian B) lizard C) bat D) opossum
7. Which of the following is typically used by a microbiologist for growing bacterial cultures in petri dishes:
A) autoclave B) incubator C) laminar flow hood D) fume hood
8. In which of the following areas of the human body would you find the tarsal?
A) foot B) wrist C) arm D) hip
9. Which of the following chemical names is NOT correctly matched with its chemical formula:
A) H_2SO_4 and sulfuric acid C) $BeCl_2$ and boron dichloride
B) HCl and hydrochloric acid D) SO_2 and sulfur dioxide
10. Ringworm is a disease caused by a:
A) virus B) bacteria C) protozoan D) fungi
11. Which of the following is the region of the body where the stapes bone is located:
A) ankle B) ear C) wrist D) knee
12. Which of the following statements is TRUE?
A) the human y chromosome has hundreds of known genes C) humans have the largest brains per body size than any other animal that has ever lived on Earth
B) mutations are changes in the genetic code found in DNA D) all infectious agents are caused by some sort of living organism
13. What part of the Sun's atmosphere can be seen during a total eclipse of the Sun?
A) Corona B) Core C) photosphere D) Chromosphere

14. Endocrine system: hormones :: Immune system : _____

- A) nutrients
- B) white blood cells
- C) skin
- D) neurons

15. What would properly describe the structure of a deoxyribonucleic acid?

- A) amino acid bases
- B) uracil
- C) double stranded
- D) sugar backbone

16. Most plants receive their nutrients from the

- A) soil
- B) water
- C) sunlight
- D) air

17. Hemoglobin is a protein found in what cell?

- A) red blood cells
- B) white blood cells
- C) liver cells
- D) neurons

18. What is the universal recipient for human blood types?

- A) A
- B) B
- C) AB
- D) O

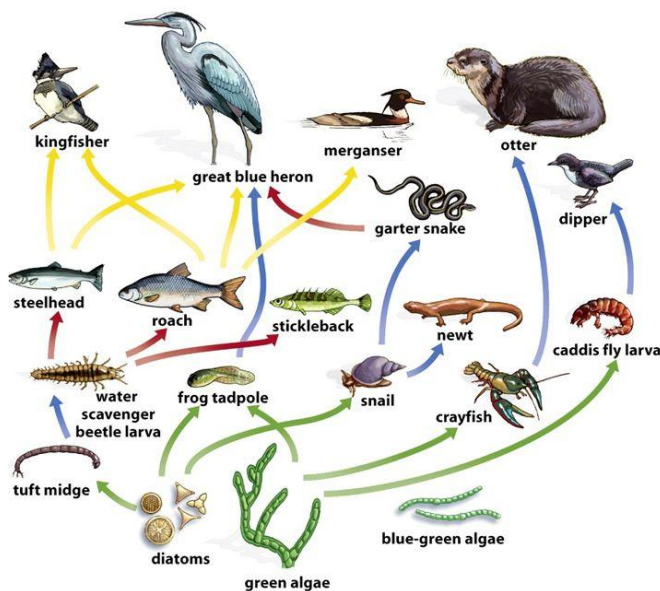
19. The prefix *inter-* used in science to form words such as interphase means?

- A) thread
- B) house
- C) cross
- D) between

20. In the electromagnetic spectrum, what type of waves have the highest energy?

- A) the shortest waves
- B) radio waves
- C) the longest waves
- D) microwaves

21. In the diagram below, the blue heron is playing which role in the ecosystem when it eats a garter snake?



- A) primary consumer and secondary trophic level
- B) tertiary consumer and fourth trophic level
- C) tertiary consumer and third trophic level
- D) secondary consumer and secondary trophic level

22. Which of the following is an ectoparasite:

- A) tape worm B) malaria C) pinworm D) lice

23. A manual laborer moves 40 kilograms of flour 5 feet above the ground in 5 seconds. If she does the same task in twice the time it involves a different amount of what:

- A) power B) work C) kinetic energy D) potential energy

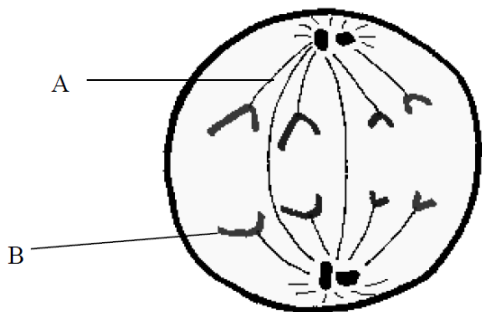
24. In sexually reproducing organisms, such as humans, which of the following statements is TRUE about the genetic information that is passed from parents to children?

- A) Sons receive most of their genetic information from their fathers, and daughters receive most of their genetic information from their mothers.
 B) All of the genetic information comes from one of the parents.
 C) Half of the genetic information comes from each of the parents.
 D) Some of the genetic information comes from each of the parents, but the amount that comes from each parent cannot be predicted.

25. About how many different types of amino acids are used to make protein molecules for human cells?

- A) One B) Three C) Twenty D) Four

26. What is this stage of the cell cycle?



- A) interphase B) prophase C) anaphase D) metaphase

27. The following DNA triplet, GAC, would have which of the following triplet on the replicated chromosome?

- A) GAC B) CCG C) CTG D) CUG

28. A cell will spend most of its time in what phase of the cell cycle?

- A) interphase B) prophase C) metaphase D) telophase

29. Sex cells (sperm or egg cells) in mice contain 20 chromosomes. How many chromosomes does the fertilized egg cell of a mouse contain?

- A) 10 B) 20 C) 40 D) 80

30. Which of the following structures are used to store molecules from food?

- A) Fat tissue in animals C) Bulbs in plants
 B) Seeds in plants D) All of the above

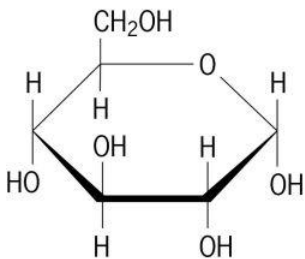
31. When water molecules move from an area of high concentration to an area of low concentration this is referred to as

- A)** osmosis. **B)** active transport. **C)** endocytosis. **D)** bulk transport.

32. Gas molecules such as carbon dioxide will move through the cell membrane by what method?

- A)** active transport **B)** simple diffusion **C)** osmosis **D)** bulk transport

33. The following structure below is that of what macromolecule?



- A)** carbohydrate **B)** protein **C)** nucleic acid **D)** lipid

34. Saturated and unsaturated bonds are found in what macromolecule?

- A)** lipids **B)** carbohydrates **C)** proteins **D)** amino acids

35. Photosynthesis takes place in cells that contain

- A)** mitochondria. **B)** lysosomes. **C)** vacuoles. **D)** chloroplasts.

36. Prokaryotic cells lack

- A)** membrane-bound organelles. **B)** a cell membrane. **C)** a cell wall. **D)** ribosomes.

37. When a freshwater cell is placed in a surrounding environment that has a high solute concentration, the environment would be

- A)** hypertonic. **B)** hypotonic. **C)** isotonic. **D)** can not be determined.

38. The movement of molecules from an area of high concentration to low concentration is referred to as

- A)** diffusion **B)** active transport **C)** exocytosis **D)** bulk transport

39. Like most animals, mice reproduce sexually. The skin cells of a mouse each contain 40 chromosomes. How many chromosomes does a sperm cell of a male mouse contain?

- A)** 10 **B)** 20 **C)** 40 **D)** 80

40. What is the genetic code?

- A) The sequence of subunits in a DNA molecule
- B) The number of subunits in a DNA molecule
- C) The sequence of subunits in a protein molecule
- D) The number of subunits in a protein molecule

41. How many nucleotides does it take to code for three amino acids?

- A) 3
- B) 6
- C) 9
- D) 12

42. Carbohydrates : energy :: proteins :: _____

- A) heredity
- B) ATP production
- C) enzymes
- D) energy storage

43. When two air masses of different densities collide it is called

- A) a high pressure zone.
- B) a hurricane.
- C) a storm.
- D) a front.

44. What color do the coolest stars appear to be?

- A) red
- B) yellow
- C) green
- D) blue

45. On the map below, where would you expect to see the lowest overall annual temperature?



- A) A
- B) B
- C) D
- D) F

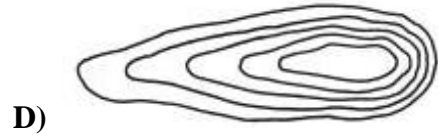
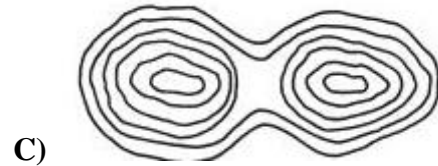
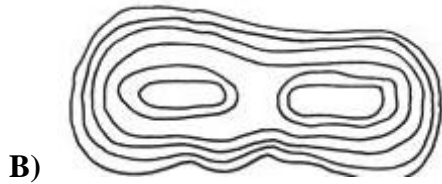
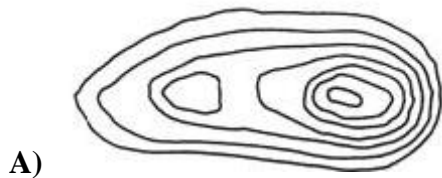
46. Which of the particles below are considered a cation?

- A) Ca^{2+}
- B) Fe
- C) O_2
- D) Cl^-

47. The prefix *muta-* used in science to form words such as mutagen means?

- A) genetic
- B) change
- C) life
- D) dislike

48. Match the correct topography map with the image below



49. How many neutrons would you find in an atom of helium?

A) 1

B) 2

C) 4

D) 0

50. Which of the following has a chitinous exoskeleton?

A) beetle

B) octopus

C) turtle

D) snake

2017-2018 TMSCA Middle School Science Test State Online Meet

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