

**TMSCA MIDDLE SCHOOL  
SCIENCE  
TEST #13 ©  
FEBRUARY 24, 2018**

**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<sup>x</sup>, ln x, y<sup>x</sup>, sin x, sin<sup>-x</sup>, cos x, cos<sup>-x</sup>, tan x, tan<sup>-x</sup>, 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

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1A 1																																																																																																					
1 H 1.008											2 He 4.003																																																																																										
		2A 2																																																																																																			
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											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95																																																																																				
		3B 3										4B 4										5B 5										6B 6										7B 7										8B 8										8B 9										8B 10										1B 11										2B 12									
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 (268)	102 No (269)	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  $0^\circ\text{C}$  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,  $m_u = 1.66 \times 10^{-21} \text{ kg}$

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 on electron =  $-1.6 \times 10^{-19} \text{ coulombs (C)}$

1 horsepower (hp) =  $746 \text{ W} = 550 \text{ ft}\cdot\text{lb/s}$

Neutron Moss =  $1.008665 \text{ au}$

Proton Mass =  $1.007277 \text{ au}$

1 au =  $931.5 \text{ MeV}$

1 calorie =  $4.184 \text{ Joules (J)}$

Specific heat of water =  $4.18 \text{ J/g}\cdot^\circ\text{C}$

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1. Which of the following is NOT one of the 10 major cloud types:  
A) cirrus                      B) cirrocumulus                      C) cirrostratus                      D) cirronimbus
2. Which of the following is the most common term biologists use for the molecule that an enzyme will act on:  
A) substrate                      B) product                      C) producer                      D) catalyst
3. The primary process in the mechanical weathering of rocks worldwide is:  
A) exfoliation                      C) thermal expansion  
B) abrasion                      D) thermal contraction
4. Chickenpox is a disease caused by a:  
A) bacteria                      B) fungus                      C) virus                      D) protozoan
5. During which month does the vernal equinox occur?  
A) March                      B) September                      C) August                      D) July
6. Galaxies are:  
A) clouds of gases around stars                      C) rare in the universe  
B) clusters of billions of stars                      D) always spherical in shape
7. The mass of a quantity of matter divided by its volume provides which specific property?  
A) weight                      B) specific gravity                      C) density                      D) malleability
8. What term do physicists and engineers use most commonly to describe a change in the velocity of an object?  
A) momentum                      B) acceleration                      C) speed                      D) displacement
9. A series of amino acids joined together will make a:  
A) polysaccharide                      B) DNA                      C) sugar                      D) protein
10. In human nerves, the nerve impulse or message occurs primarily because of the movement of ions of what two elements across the cell membranes of nerves:  
A) sodium and potassium                      C) calcium and sodium  
B) potassium and calcium                      D) calcium and magnesium
11. Which of the following is the organ mainly responsible for producing digestive enzymes and insulin:  
A) spleen                      B) liver                      C) thyroid                      D) pancreas
12. Hot springs are sources of which of the following types of energy?  
A) Hydroelectric                      B) Geothermal                      C) Solar                      D) Fossil fuel
13. If wind speeds in a storm are clocked in excess of 200 mph, this is most likely a measurement within a :  
A) typical thunder                      B) tornado                      C) hurricane                      D) microburst  
storm

14. Which of the following is NOT characteristic of mitosis:

- A)** chromosomes line up on an equatorial plate  
**B)** occurs in somatic cells  
**C)** crossing over  
**D)** preceded by the disappearance of the nuclear membrane

15. Which of the following occurs during a lunar eclipse?

- A)** the moon passes between the Earth and the Sun  
**B)** the Earth passes between the Sun and the Moon  
**C)** the Sun passes between the Earth and the Moon  
**D)** Solar flares increase in intensity

16. In pursuit of an insect, a lizard, braced against a rock, accelerates with a horizontal magnitude of 15 meters per second squared. How much horizontal force, in newtons, must the lizard exert on the rock to produce this acceleration if the lizard has a mass of 3 kilograms?

- A)** 35 N  
**B)** 45 N  
**C)** 5 N  
**D)** 55 N

17. Which of the following is most accurate about the pasteurization of milk:

- A)** it makes milk taste better  
**B)** it kills all bacteria by sterilizing the milk  
**C)** it lowers the milk's pH  
**D)** it reduces the population of bacteria by heating but not boiling the milk

18. Which of the following elements is found in Period 2 and Group 4A of the Periodic Table:

- A)** sulfur  
**B)** carbon  
**C)** nitrogen  
**D)** oxygen

19. Which of the following infectious diseases cannot be cured with current antibiotics:

- A)** strep throat  
**B)** toxic shock syndrome  
**C)** scarlet fever  
**D)** influenza

20. Governments banned the production and use of what group of chemicals because of the damage they do to the ozone layer.

- A)** phenols  
**B)** tetra-methanes  
**C)** chlorofluorocarbons  
**D)** ozoneaters

21. What is the part of the brain that is most directly involved in walking and coordination?

- A)** Pre-frontal lobe  
**B)** Cerebrum  
**C)** Medulla  
**D)** Cerebellum

22. For a brick of gold, which of the following properties would change if you transported the brick from the surface of the Earth to the surface of the Moon?

- A)** Mass  
**B)** Weight  
**C)** Volume  
**D)** Density

23. According to the principle of complementary base pairing, if you have DNA that consists of 15% thymine, what is the percentage of cytosine in the molecule?

- A)** 15%  
**B)** 35%  
**C)** 70%  
**D)** 30%

24. Which can be found in both prokaryotic and eukaryotic cells?

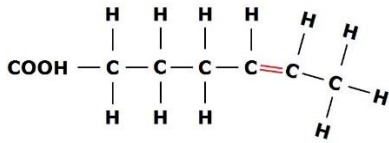
- A)** mitochondria  
**B)** chloroplasts  
**C)** peptidoglycan  
**D)** flagella

25. Which of the following is a physical change?

- A)** Combustion  
**B)** Electrolysis  
**C)** Sublimation  
**D)** Fermentation

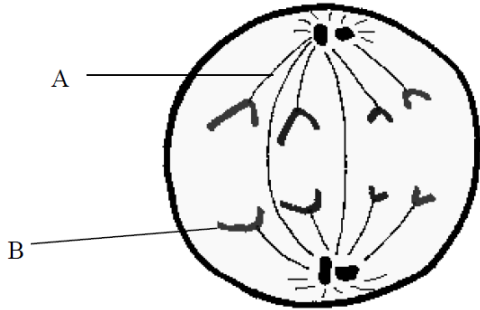
26. Which of the following is NOT a process of plate tectonics?  
A) Continental drift      B) Seafloor spreading      C) Subduction      D) Upwelling
27. Which of the following best classifies iodine?  
A) Halogen      B) Inert gas      C) Compound      D) Alkali metal
28. Which of the following elements is found in DNA?  
A) Calcium      B) Phosphorus      C) Zinc      D) Helium
29. UV radiation is most damaging to which human organ?  
A) Heart      B) Lungs      C) Skin      D) Liver
30. Which of the following is NOT a consequence of a drought?  
A) Increased electricity due to wind generation      C) Diminished crop yields  
B) Snake migration and increases in snake bites      D) Dust storms
31. Why does the same side of the Moon always face the Earth?  
A) The Moon rotates about its axis about once per month      C) The Moon and the Earth rotate about their axes at the same rate  
B) The Moon rotates about its axis about once per year      D) The Moon does not rotate about its axis
32. Mass is measured with a  
A) graduated cylinder      B) test tube      C) beaker      D) balance scale
33. During which cell cycle phase are two daughter cells created?  
A) interphase      B) metaphase      C) anaphase      D) telophase
34. Dendrites and axons are structures found in  
A) paramecium      B) neurons      C) red blood cells      D) algae
35. Which of the following organisms is not a protist?  
A) amoeba      B) algae      C) moss      D) volvox
36. Which of the following macromolecules provides the most energy per gram?  
A) lipids      B) carbohydrates      C) proteins      D) amino acids

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



- A) lipid                                      B) protein                                      C) carbohydrate                                      D) amino acid
38. Monosaccharides are the basic building block of  
 A) lipids                                      B) nucleic acids                                      C) carbohydrates                                      D) proteins
39. Which macromolecule catalyzes reactions?  
 A) proteins                                      B) carbohydrates                                      C) nucleic acids                                      D) lipids
40. What function do enzymes perform for a chemical reaction?  
 A) They are a catalyst.                                      C) Enzymes can not alter a reaction.  
 B) They change the product.                                      D) They increase the energy needed for a chemical reaction.
41. An example of a nucleic acid would include?  
 A) RNA                                      B) protein                                      C) amylase                                      D) triglyceride
42. Large molecules such as starch can be transported into the cell by what method?  
 A) osmosis                                      C) passive transport  
 B) active transport                                      D) simple diffusion
43. Plants will convert dissolved nitrates with the use of what organism found in a root nodules?  
 A) algae                                      B) protists                                      C) bacteria                                      D) fungi
44. What do prokaryotic cells contain?  
 A) cell membrane                                      B) mitochondria                                      C) nucleus                                      D) chloroplast
45. What is not part of the endocrine system?  
 A) heart                                      B) pituitary gland                                      C) thyroid gland                                      D) adrenal gland
46. Which of the following is a member of the whale family?  
 A) tiger shark                                      B) narwhal                                      C) barracuda                                      D) stingray
47. DNA that is not tightly wrapped around proteins would be referred to as  
 A) a chromosome.                                      B) chromatin.                                      C) a chromatid.                                      D) nucleotide.

48. The “A” in the image below is pointing to what structure?



- A) chromosome                      B) centriole                      C) spindle fiber                      D) cell membrane

49. Among these biotic components of the ecosystem, which of the following would be the producer?

- A) green algae                      B) fungi                      C) yeast                      D) amoeba

50. Which of the following is a characteristic of living things?

- A) cell wall                      C) sexual reproduction  
 B) genetic material                      D) movement

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