



**TMSCA MIDDLE SCHOOL
SCIENCE
BANA INVITATIONAL ©
AUGUST 20, 2016**

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, 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.**
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

1A	1 H 1.008	2A																	8A					
	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 23.00	12 Mg 24.31	3B	4B	5B	6B	7B	8B				1B	2B	3A	4A	5A	6A	7A	4003					
	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	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 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3						
	55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)						
	87 Fr (223)	88 Ra 226.0	89 Ac 227.0	104 Rf (261)	105 Ha (262)	106 Unh (263)	107 Uns (262)		109 Une (267)															

Lanthanides	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
Actinides	90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np 237.0	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 (260)

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 Petit'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, $m_a = 1.66 \times 10^{-27} \text{ kg}$

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

2016 TMSCA BANA Invitational MS Science Test

1. Marlins, bass, perch, and cod could be included in which field of science?
A. astronomy B. botany C. endocrinology D. ichthyology
2. Which planet has moons that include Titania, Umbriel and Oberon?
A. Saturn B. Jupiter C. Uranus D. Neptune
3. Squamous, cuboidal and columnar are examples of what kind of human tissue?
A. connective B. epithelial C. muscular D. nervous
4. In mammals, which body system contains the trapezius, soleus and gluteus maximus?
A. digestive B. muscular C. skeletal D. circulatory
5. An example of a speleothem is a/an _____.
A. cognate B. lava cone C. stalagmite D. asteroid
6. Potassium, sodium and lithium are examples of _____.
A. alkali metals B. noble gasses C. transition metals D. precious metals
7. The soft spot in the cranium of a human baby is the _____.
A. channel B. morphine C. dubious D. fontanel
8. The parietal lobe and occipital lobe are located in the _____.
A. heart B. liver C. brain D. pancreas
9. Which of these instruments measures wind speed?
A. barometer B. tachometer C. agmometer D. anemometer
10. Who was the American medical researcher who developed the first polio vaccine?
A. Oppenheimer B. Salk C. DeBakey D. Cooley
11. In which USA manned mission program did Alan Shepard first go into space?
A. Apollo B. Mercury C. Gemini D. Saturn
12. How many hectograms are in 467352 centigrams of lava?
A. 46.7352 B. 4673.52 C. 467.352 D. 467,352,000
13. Which of these is not part of the composition of a nucleotide?
A. guanine B. adesine C. cytosine D. thymine
14. Which animal is not classified as a primate?
A. spider monkey B. baboon C. marmot D. mandrill
15. Which of these planets is closest in size to the Earth?
A. Venus B. Mars C. Mercury D. Neptune

16. What anatomical structure is attached to the stomach and leads to the jejunum?
A. epiglottis B. uvula C. duodenum D. cecum
17. What type of organelles are the center of energy production and respiration?
A. vacuole B. mitochondrion C. vesicle D. ribosome
18. The sidereal month for the Earth's moon is 27.3 days. How long is the synodic month?
A. 24.6 days B. 30.7 days C. 29.5 days D. 36.25 days
19. How many atoms of oxygen are represented in this mixture: $\text{Cu}(\text{OH})_2 + \text{CaSO}_4$?
A. 4 B. 5 C. 2 D. 6
20. Which of these was a theoretical physicist who worked at Los Alamos in the Manhattan Project?
A. J. Robert Oppenheimer B. Albert Einstein C. Louis Pasteur D. Werner Von Braun
21. The medulla oblongata is part of the _____.
A. large intestine B. brain C. heart D. pancreas
22. A platypus is an example of a/an _____, a mammal that lays eggs.
A. marsupial B. monotreme C. monocyte D. mesophyte
23. Which planet has many moons, including Enceladus, Rhea and Dione?
A. Uranus B. Jupiter C. Saturn D. Neptune
24. Who is known as the inventor of the Analytical Engine?
A. Charles Babbage B. John Harington C. Arthur Conan Doyle D. Albert Einstein
25. A period of metabolic depression in endotherms is called _____.
A. cognition B. hibernation C. endopression D. exhalation
26. Which of these is not a classification of teeth?
A. incisor B. molar C. cuspid D. bimolar
27. Which of these life forms does not normally inhabit a taiga biome?
A. bear B. pine C. dromedary D. larch

28. Which of these animals is primarily a herbivore?
 A. hawksbill turtle B. moose C. lion D. whale
29. The study of tornadoes and hurricanes is included in the field of _____.
 A. meteorology B. endocrinology C. geology D. chemistry
30. What is the classification of the Earth's moon when it is more than half lighted but less than full?
 A. waxing B. waning C. gibbous D. tepid
31. Who was the scientist who developed a way to render milk safe for consumption?
 A. Edmund Halley B. Louis Pasteur C. Edwin Budding D. Gregor Mendel
32. The study of bird eggs is called _____.
 A. ovalogy B. oology C. egtomology D. logology
33. Animals that originate naturally in a given place are _____ to that area.
 A. igneous B. oedipous C. synchronous D. indigenous
34. Which of these animals does not belong in this group?
 A. anteater B. armadillo C. marmot D. aardvark
35. In computer programming, which is the measurement for 8 bits of binary code?
 A. CPU B. RAM C. ROM D. BYTE
36. A group of alligators is called a congregation. A group of bears can be called a _____.
 A. prowl B. aggregate C. mob D. sleuth
37. In computer hardware, which of these components was used in the second generation of computers?
 A. vacuum tubes B. transistors C. VLSI circuits D. integrated circuits
38. In the contiguous United States, how many mountains exceed 15,000 feet above sea level?
 A. zero B. one C. three D. five

39. Spider monkeys and sloths are indigenous to _____.
A. Costa Rica B. Rwanda C. Germany D. Turkey
40. Forms of this metal are used in topical creams, catheters, x-ray film, newborn eye drops, water purifiers and hip joint implants. Which metal has these uses?
A. gold B. platinum C. aluminum D. silver
41. The human organ that contains the islets of Langerhans is the _____.
A. liver B. thyroid C. kidney D. pancreas
42. Which of these is not a part of the pistil of a flower?
A. stigma B. stamen C. ovary D. style
43. A cardiologist might operate on which of these body parts?
A. aorta B. pelvis C. kidney D. brain
44. Which astronauts were the youngest and oldest, respectively, to be travelers in space?
A. Titov and Glenn B. Gagarin and Armstrong C. Aldrin and Glenn D. Volkov and Glenn
45. Which human organ contains alpha cells and beta cells?
A. liver B. lung C. kidney D. pancreas
46. Which of these is not an acronym for one of the early computers?
A. EDSAC B. UNIVAC C. ARNAC D. ENIAC
47. The basic functional unit of the kidney is the _____.
A. globule B. islet C. neuron D. nephron
48. Alveoli are also called _____.
A. air sacs B. fungal appendages C. capillaries D. synaptic neurons
49. Methane, propane and butane are examples of _____.
A. coagulants B. elements C. hydrocarbons D. inert gases
50. Which of these animals is not a pachyderm?
A. rhinoceros B. hippopotamus C. elephant D. giraffe

2016-2017 TMSCA BANA MS Science Answer Key

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