



**TMSCA ELEMENTARY
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 on Scantrons and Chatsworth cards.
3. If you are using a Chatsworth or Scantron card, please follow the specific instructions given at your particular meet.
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. Calculators **MAY NOT** be used on this test.
8. 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.
9. In case of ties, percent accuracy will be used as a tie breaker.

Periodic Table of the Elements

1A																	8A
1	2A											3A	4A	5A	6A	7A	4003
H 1.008												B	C	N	O	F	Ne
3 Li 6.941	4 Be 9.012											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
11 Na 23.00	12 Mg 24.31	3B	4B	5B	6B	7B	8B			1B	2B	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
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	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
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	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
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	109 Une (267)					
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Ha (262)	106 Unh (263)	107 Uns (262)											

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, $N = 6.02 \times 10^{23}$ 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 = $4.18 \text{ J/g}\cdot^\circ\text{C}$

2016-2017 TMSCA BANA Invitational Science Test

1. Phobos and Deimos are moons that orbit around which planet?
A. Mars B. Jupiter C. Saturn D. Neptune
2. The intersection of the x and y axes in a coordinate plane is called the _____.
A. vertex B. apex C. fulcrum D. origin
3. What is the second most common gas in the Earth's atmosphere?
A. carbon dioxide B. hydrogen C. nitrogen D. oxygen
4. An animal that eats flora and fauna is a/an:
A. omnivore B. carnivore C. predator D. herbivore
5. What is the solid outer layer of the Earth?
A. lithosphere B. exosphere C. mesosphere D. stratosphere
6. Which of these trees is not coniferous?
A. spruce B. pine C. redwood D. elm
7. What is the basic functional unit of the nervous system?
A. alveolus B. neuron C. vein D. bronchus
8. Which planet in our solar system is the largest?
A. Neptune B. Saturn C. Jupiter D. Uranus
9. From these choices, what is the smallest group in the classification of living things?
A. genus B. class C. family D. order
10. Marble and gneiss are examples of what type of rock?
A. sedimentary B. igneous C. metamorphic D. graphic
11. Which scientist is known for his theory of relativity?
A. Newton B. Edison C. Mendel D. Einstein
12. Which of these anatomical parts is a bone in the human ear?
A. anvil B. axon C. leukocyte D. nephron
13. Of these elements, which is the least common element in the human body?
A. hydrogen B. carbon C. nitrogen D. oxygen
14. What branch of science deals with the study of heat?
A. geology B. gastronomy C. thermodynamics D. anthology
15. Who challenged Edison in the controversy over direct or alternating electric current?
A. Spencer B. Tesla C. Teller D. Torricelli

16. Which of these stars is closest to Earth?
A. Vega B. Betelgeuse C. Sirius D. Alpha Centauri
17. Which of these substances aids in the digestion of food?
A. mucus B. cartilage C. saliva D. ambergris
18. A baby kangaroo is called a joey. A baby gorilla is called an infant.
What is a name for a baby giraffe?
A. calf B. kid C. nymph D. leveret
19. In the human digestive system, which organ secretes insulin?
A. stomach B. pancreas C. esophagus D. bronchus
20. Which of these has a molecular mass greater than the molecular mass of air?
A. helium B. hydrogen C. oxygen D. carbon monoxide
21. Which of these is a thin thread-like structure that protozoa use for movement?
A. phloem B. cotyledon C. xylem D. flagellum
22. Which of these bones is located in the torso?
A. femur B. radius C. sternum D. ulna
23. Water is necessary to life on earth. Twelve molecules of water contains how many atoms of hydrogen?
A. 1200 B. 24 C. 60 D. 12
24. Which scientist developed three laws that describe the motion of planets around the sun?
A. Copernicus B. Galileo C. Archimedes D. Kepler
25. How many miles are in 52,800 feet?
A. 11 B. 10 C. 20 D. 12
26. What is a branch of science that studies slate and schist?
A. geology B. morphology C. entomology D. cetology
27. What unit is used to measure the frequency of sound waves?
A. erg B. joule C. newton D. hertz
28. Which of the following planets orbits farthest from the Sun?
A. Uranus B. Saturn C. Jupiter D. Neptune
29. What is the name for a red blood cell that supplies oxygen to the cells?
A. platelet B. erythrocyte C. leukocyte D. plasma

30. An adjective that refers to cattle, buffalo and yaks is _____.
- A. bovine B. equine C. cervine D. canine
31. What process describes the tendency toward a stable equilibrium between physiological processes?
- A. homeostasis B. mitosis C. osmosis D. meiosis
32. Which of these mountains exceeds 20,000 feet above sea level?
- A. Pike's Peak B. Mt. Mitchell C. Mt. Rogers D. Mt. Denali
33. Which of these substances is secreted by the liver?
- A. cartilage B. bile C. xylem D. saliva
34. Which of these animals is not a mammal?
- A. deer B. squirrel C. robin D. dog
35. Which of these is a hot spring characterized by intermittent discharges of water and steam?
- A. isthmus B. typhoon C. geyser D. atoll
36. Which of these body parts removes wastes and poisons from the body?
- A. pancreas B. mandible C. kidney D. thyroid
37. A mixture of metals such as bronze and tin is a/an _____.
- A. element B. alloy C. coagulant D. android
38. Isaac Newton invented the mathematic discipline called calculus. Who is also credited with independently inventing calculus while living in Germany?
- A. Braun B. Leibniz C. Copernicus D. Faraday
39. Sawyer, Swan, Albon and Edison were important in the development of the _____.
- A. microscope B. telescope C. thermometer D. incandescent lamp
40. The tendency of an object to remain at rest, or continue in motion in a straight line unless acted upon by outside forces is called _____.
- A. acceleration B. inertia C. weight D. momentum
41. The basic unit of electric power is the:
- A. volt B. watt C. lumen D. ampere
42. Which element is a blue metal used in paints, medicines, steel alloys, the manufacture of vitamin B₁₂ and the glazing of pottery and ceramics?
- A. cobalt B. carbon C. gypsum D. aluminum

43. Which of these bones is located in the human leg?
A. humerus B. mandible C. clavicle D. patella
44. What is the biological process by which organisms convey oxygen to cells and remove carbon dioxide and water from the cells?
A. synthesis B. respiration C. osmosis D. ketosis
45. Which is not a part of the nervous system?
A. axon B. capillary C. neuron D. brain
46. What is the term for the biological substance that includes fats, sterols and waxes?
A. testosterone B. sugar C. lipid D. saliva
47. What instrument records the distance traveled by a vehicle?
A. barometer B. anemometer C. tachometer D. odometer
48. What is the highest point in Arizona?
A. Humphreys Peak B. Mt. Rogers C. Denali D. Guadalupe Peak
49. What adjective describes a group of animals that includes the lion and tiger?
A. canine B. ovine C. equine D. feline
50. A group of bees is called a hive or swarm. A group of bison is called a herd. What is the name for a group of clams?
A. bed B. wreck C. clutter D. dole

2016-2017 TMSCA BANA Science EL Test Answer Key

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