



TMSCA ELEMENTARY SCIENCE BANA INVITATIONAL © 2017

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	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95	
	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 = $4.18 \text{ J/g}\cdot^\circ\text{C}$

2017-2018 Elementary TMSCA/BANA Invitational Science Test

1. Europa and Ganymede are moons that orbit around which planet?
A. Mars B. Jupiter C. Saturn D. Neptune
2. The point on which a lever pivots is called the _____.
A. vertex B. apex C. fulcrum D. origin
3. Which of these animals is a pachyderm?
A. elephant B. robin C. giraffe D. cobra
4. An animal that eats only meat is a(an) _____.
A. omnivore B. carnivore C. predator D. herbivore
5. What is the second layer of the Earth's atmosphere, located just above the troposphere?
A. lithosphere B. exosphere C. mesosphere D. stratosphere
6. Which of these trees is a conifer?
A. spruce B. oak C. mulberry D. elm
7. Which of these anatomical units is located in the lungs?
A. alveolus B. humerus C. clavicle D. sternum
8. Which of these planets is located farthest from Venus?
A. Neptune B. Saturn C. Jupiter D. Mercury
9. From these choices, what is the largest group in the classification of living things?
A. genus B. class C. family D. order
10. Schist and slate are examples of what type of rock?
A. sedimentary B. igneous C. metamorphic D. graphic
11. Which scientist is known for his three laws of motion?
A. Newton B. Mauchly C. Mendel D. Edison
12. Which of these anatomical parts is a bone in the human ear?
A. stirrup B. dendrite C. leukocyte D. nephron
13. Of these elements, which is the most common element in the Earth's atmosphere?
A. hydrogen B. carbon C. nitrogen D. oxygen
14. What branch of science deals with the study of rocks that compose the solid Earth?
A. astronomy B. gastronomy C. thermodynamics D. geology
15. Who challenged Tesla in the controversy over direct or alternating electric current?
A. Spencer B. Edison C. Teller D. Torricelli

16. Which of these bones is located in the knee?
A. clavicle B. patella C. sternum D. cranium
17. Which of these substances serves as a cushion against vibration in joints?
A. cochlea B. cartilage C. saliva D. ambergris
18. A baby dog is called a pup. A baby dolphin is called a pup or calf.
What is a name for a baby donkey?
A. foal B. kid C. squab D. cub
19. In the human digestive system, which organ produces gastric acid?
A. stomach B. pancreas C. sternum D. bronchus
20. Which of these elements is contained in pure water?
A. helium B. hydrogen C. nitrogen D. carbon
21. The vascular tissue that conducts water and nutrients upward in a plant stem is _____.
A. phloem B. cotyledon C. xylem D. flagellum
22. Which of these bones is located in the human arm?
A. femur B. tibia C. sternum D. ulna
23. Water is necessary to life on earth. Twelve molecules of water contains how many atoms of oxygen?
A. 36 B. 24 C. 60 D. 12
24. Which scientist championed the idea of heliocentrism, observed sunspots, and discovered the four largest moons of Jupiter?
A. Copernicus B. Galileo C. Archimedes D. Kepler
25. How many miles are in 528,000 feet?
A. 110 B. 100 C. 200 D. 120
26. What is a branch of science that studies marble 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 closest to the Sun?
A. Uranus B. Saturn C. Jupiter D. Neptune
29. What is the name for the liquid in blood that remains when platelets, red blood cells, and white blood cells have been removed?
A. carcinogen B. erythrocyte C. leukocyte D. plasma

30. The highest mountain in Texas is _____.
- A. Jacinto Peak B. Mount Crockett C. Alamo Hill D. Guadalupe Peak
31. What process involves one division of a cell and results in two daughter cells?
- A. homeostasis B. mitosis C. osmosis D. meiosis
32. Which of these mountains exceeds 14,000 feet above sea level?
- A. Pike's Peak B. Mt. Mitchell C. Mt. Rogers D. Baxter Peak
33. Which of these substances is secreted by the liver?
- A. lymph B. estrogen C. bile D. saliva
34. Which of these animals is not a mammal?
- A. deer B. squirrel C. perch D. dog
35. Which term designates a hurricane in the western Pacific region?
- A. isthmus B. typhoon C. geyser D. atoll
36. Which of these body parts helps regulate hormones that affect metabolism?
- A. cochlea B. mandible C. heart D. thyroid
37. A substance that causes blood to form a scab after an injury is a/an _____.
- A. element B. annuitant C. coagulant D. android
38. Leibnitz invented a mathematic discipline called calculus. Who is also credited with independently inventing calculus while living in England?
- A. Einstein B. Newton C. Copernicus D. Faraday
39. Hans Lippershey, Zacharias Janssen, and Jacob Metius were important in the development of the _____.
- A. microscope B. telescope C. thermometer D. incandescent lamp
40. An object's relative mass is called _____.
- A. acceleration B. inertia C. weight D. momentum
41. The basic unit of electric current is the:
- A. volt B. watt C. lumen D. ampere
42. Which substance is a soft sulfate mineral used as a fertilizer and as the main ingredient in many forms of plaster, blackboard chalk and wallboard?
- A. cobalt B. carbon C. gypsum D. aluminum

43. Jonas Salk and Albert Sabin helped develop a vaccination for _____.
A. small pox B. measles C. mumps D. polio
44. Which of these stars is a red supergiant that is part of the Orion constellation?
A. Vega B. Betelgeuse C. Sirius D. Alpha Centauri
45. Which is not a part of the nervous system?
A. axon B. dendrite C. neuron D. sternum
46. Which substance is a hormone involved in the growth, maintenance and repair of reproductive tissues?
A. testosterone B. sugar C. lipid D. saliva
47. What instrument measures atmospheric pressure?
A. barometer B. anemometer C. tachometer D. odometer
48. What is the highest point in Virginia?
A. Mount Marcy B. Mt. Rogers C. Denali D. Guadalupe Peak
49. What adjective describes a group of animals that includes the Clydesdale and Mustang?
A. canine B. ovine C. equine D. feline
50. A group of cobras is called a quiver. A group of caribou is called a herd. What is the name for a group of bears?
A. battery B. brood C. sedge D. sleuth

2017-2018 Elementary BANA/TMSCA Science Test Answer Key

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