

**TMSCA MIDDLE SCHOOL
SCIENCE
TEST #12 ©
FEBRUARY 16, 2019**

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

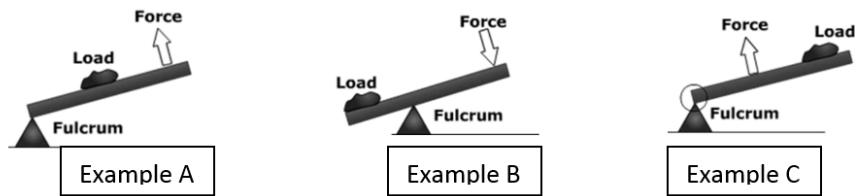
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1. What list correctly shows the six most common elements found in living things?
 - A. Carbon, Silicon, Copper, Zinc, Iron, Hydrogen
 - B. Carbon, Hydrogen, Oxygen, Phosphorus, Nitrogen, Sulfur
 - C. Carbon, Helium, Osmium, Potassium, Nickel, Silicon
 - D. Carbon, Sulfur, Nitrogen, Oxygen, Potassium, Hydrogen
2. Between the A ring and B ring of Saturn, there is a large dark gap. This was named after which French astronomer?
 - A. Domenico Cassini
 - B. Edmund Halley
 - C. Ole Romer
 - D. Edwin Hubble
3. A streamline symmetrical hill composed of glacial till is called a what?
 - A. col
 - B. caprock
 - C. conduit
 - D. drumlin
4. The tendency of something to stay in motion or stay at rest is called what?
 - A. balance
 - B. momentum
 - C. forces
 - D. inertia
5. A large gray cat was resting on a cat tower's top shelf. The cat is in a state of equilibrium. The force applied by gravity on the cat on the shelf and the force applied by the shelf to the cat are what?
 - A. The forces are the same, and are also in the same direction
 - B. The forces are the same, but in opposite directions.
 - C. The force that gravity applies to the cat on the shelf is slightly more than the force of the shelf to the cat.
 - D. The force that the shelf applies to the cat is more than the force of gravity on the cat.
6. Which of the following scientists made a major contribution in the field of chemistry?
 - A. Domenico Cassini
 - B. Edwin Hubble
 - C. Ptolemy
 - D. Ernest Rutherford
7. Milkweed leaves have a toxin that can be poisonous to many animals. What type of toxin is in milkweed?
 - A. cardenolides
 - B. arsenic
 - C. amygdalin
 - D. cyanide
8. Which of the following is found in a plant cell, but not in an animal cell?
 - A. cell membrane
 - B. cell wall
 - C. mitochondrion
 - D. cytoplasm

9. When a scientist gathers data during research through observation and experimentation this is called what?
 - A. variance data
 - B. covariate
 - C. empirical data
 - D. theoretical curves

10. Some naturally occurring “carbon sinks” include all of the following except what?
 - A. ocean
 - B. plants
 - C. soil
 - D. power plant

11. What is the SI unit to measure power?
 - A. ampere
 - B. watt
 - C. hertz
 - D. Newton



12. Which example shows the arrangement of a first-class lever?
 - A. Example A
 - B. Example B
 - C. Example C
 - D. none of these

13. During a lab activity, the following measurements were recorded. What do these measurements show?
 - A. Measurement 1 is precise.
 - B. Measurement 4 is accurate, but not precise.
 - C. Measurement 3 precise, but not accurate.
 - D. Measurement 2 is both precise and accurate.

Measurement	Day 1	Day 2	Day 3	Actual Standard Value
1	7.45	5.44	8.45	5.1
2	9.001	9.001	9.002	9.000
3	16.4	17.1	19.0	10.5
4	3.22	3.22	3.22	6.0

14. What is the difference between “local extinction” and “extirpation?”
 - A. They mean the same thing.
 - B. Local extinction means only temporary loss of a species.
 - C. Extirpation means a permanent loss of a species.
 - D. They have opposite meanings.

15. Some areas of Texas have dry climates and get little rainfall or have precipitation only at certain times of the year. In these areas, there are streams that flow less than 30 days a year. These streams are called what?
 - A. Perennial streams
 - B. Ephemeral streams
 - C. Intermittent streams
 - D. Creeks


16. This model shows a glucose molecule. Which below is the chemical name for glucose?



- A. $C_4H_8O_4$
B. $C_{12}H_6O_6$
C. $C_6H_6O_{12}$
D. $C_6H_{12}O_6$
17. The reaction of sodium and chlorine to form sodium chloride is what type of chemical reaction?
A. combustion B. combination C. neutralization D. displacement
18. Which of these is the best definition for an earthquake?
A. a crack in the Earth's surface
B. a push of the tectonic plate into another plate
C. a vibration of Earth produced by the rapid release of energy
D. shaking of the Earth when gravity pulls on rock
19. The longest time unit on the geologic scale is called what?
A. era B. period C. eon D. epoch
20. A structural formula that shows all the atoms and valence electrons in a molecule is called what?
A. octet rule B. ketone C. redox D. Lewis structure
21. Devil's Tower, our nation's first national monument, is an interesting geologic structure formed by what?
A. sedimentary layers and scree
B. volcano
C. magma from an igneous intrusion that cooled slowly and then eroded
D. mashed potatoes
22. A student in chemistry class was measuring the length of several samples. One sample was measured at 4,000 mm. The student realized that the unit needed to be in kilometers for the calculations to be completed. What would this sample be in kilometers?
A. 400 km B. 4 km C. 0.04 km D. 0.004 km
23. Which two sciences areas of study would be most important to a paleontologist?
A. physics and biology
B. chemistry and physics
C. geology and chemistry
D. biology and geology

24. Which of the following is a balanced chemical equation?
- A. $\text{H}_2 + \text{Cl}_2 \rightarrow 4\text{HCl}$
 - B. $\text{N}_2 + 3\text{H}_2 \rightarrow 3\text{NH}_3$
 - C. $2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$
 - D. $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_2$
25. When discussing ecological succession, is it possible for a grassland to be considered a “climax community”?
- A. No, because there are no tall trees or forests.
 - B. No, because grass is never the final step in ecological succession.
 - C. Yes, because the climate may not allow for further succession; the ecosystem is stable.
 - D. Yes, because primary and secondary succession have both taken place.
26. Which of the following statements about wind is correct?
- A. Wind moves from areas of high pressure to areas of low pressure
 - B. Wind is named from the direction it blows from, not to.
 - C. Wind is caused by the uneven heating of the Earth’s surface by the sun.
 - D. All of the above
27. Cartilage is made up of cells called what?
- A. chondrocytes
 - B. hemocytes
 - C. erythrocytes
 - D. neutrophils
28. Which of the following facts about gluten is not a proven fact?
- A. gluten is a protein
 - B. gluten is found in wheat, barley, and rye
 - C. gluten-free diet helps you lose weight
 - D. gluten helps bread expand when the dough is rising
29. Jason needed to know the density of the cube of metal he was using for an experiment. The cube was 5 cm long. When he found the cube’s mass, it measured 450 grams. Does he have enough information to find the cube’s density?
- A. Yes, the density of the cube is 18 g/cm^3
 - B. Yes, the density of the cube is 3.6 g/cm^3
 - C. No, you need to know the volume
 - D. No, you need to know the width and height of the cube.
30. On the pH scale, a solution with the measure of 3 is how many times less acidic than one with a pH of 4?
- A. 10
 - B. 100
 - C. 1000
 - D. 10000
31. What is the best method to identify which mineral is calcite and which is feldspar?
- A. Color is always a good way to tell minerals apart.
 - B. Check to see if they can be picked up by a magnet.
 - C. Put a few drops of vinegar on each. The calcite will bubble, and feldspar will not.
 - D. Check to see which one will sink in water

32. How many neutrons would a neutral atom of Iron have?
A. 26 B. 56 C. 30 D. 82
33. What is specific gravity of a liquid or solid?
A. The ratio of an object's density compared to the density of an equal volume of water.
B. The ratio of an object's density compared to the object's volume.
C. The ratio of an object's mass compared to twice its volume in water.
D. The ratio of an object's volume compared to the mass of the same object.
34. Changes in normal surface temperatures of the ocean can impact global weather and climate. Two important terms describing temperature changes in the equatorial Pacific are El Nino and La Nina. Which statement below describes these phases?
A. El Nino is the warm phase and La Nina is the cold phase.
B. El Nino is the cold phase and La Nina is the warm phase.
C. El Nino is the dry phase and La Nina is the wet phase.
D. El Nino is the wet phase and La Nina is the dry phase.
35. The prefix "amyl" means what?
A. happy B. emotion C. starch D. food
36. The parts of cells can be compared to a classroom. If the teacher provides instructions for the classroom, then what part of the cell would be considered the teacher?
A. cytoplasm B. endoplasmic reticulum C. nucleus D. lysosomes
37. About how long did it take the astronauts to reach the moon?
A. 9 months B. 1 year C. 3 days D. 37 hours
38. What does the prefix "brachy" mean when added to a root word?
A. tall B. tube C. right D. short
39. Who was the third astronaut on Apollo 11 who stayed in the spacecraft and did not walk on the moon?
A. Buzz Aldrin B. Jim Lovell C. Neil Armstrong D. Michael Collins
40. Which of the following statements about Earthquake Primary waves is not true?
A. Primary waves are the fastest of the seismic waves.
B. Primary waves or "P" waves are also called compressional waves.
C. Primary waves can only move through solids.
D. Primary waves move as transverse waves.

41. What was created to help chemists connect the large-scale world with the particulate world of atoms, molecules, and ions?
- A. the mole unit
 - B. chemical recipes
 - C. balanced equations
 - D. none of these
42. The inner core of the Earth is believed to be made of what?
- A. molten rock
 - B. solid iron and nickel
 - C. silica
 - D. liquid iron
43. When a satellite orbits a planet in an elliptical orbit, the closest approach to the planet is called the _____ and the farthest point of the satellite orbit is called the _____.
- A. apogee, perigee
 - B. parallax, azimuth
 - C. azimuth, parallax
 - D. perigee, apogee
44. Which statement about oxygen is not true?
- A. Air has more oxygen than water at the same temperature.
 - B. Oxygen is the 8th element on the Periodic Table.
 - C. Oxygen has an atomic mass of about 8.
 - D. Oxygen makes up 21% of Earth's atmosphere.
45. What moon of Jupiter has been considered to be able to support life because of the ocean of water believed to be under the frozen surface?
- A. Io
 - B. Ganymede
 - C. Titan
 - D. Europa
46. What is the approximate atomic mass for Gold?
- A. 79
 - B. 69
 - C. 47
 - D. 197
- 
47. The "building blocks" of protein are what?
- A. amino acids
 - B. enzymes
 - C. isotopes
 - D. polymers
48. A measure of 4 mechanical horsepower would equal how many watts?
- A. 1,492 W
 - B. 3,000 W
 - C. 746 W
 - D. 2,984 W
49. Which of the following is the best definition for biofuels?
- A. energy given off by living things
 - B. energy sources derived from carbon stored in living organisms
 - C. energy found stored in bonds of special chemicals
 - D. nonrenewable sources obtained from plants

50. If potassium chloride is mixed with a solution of silver nitrate, a white insoluble solid material is formed. This would be an example of what type of chemical reaction?
- A. combustion
 - B. neutralization
 - C. displacement
 - D. precipitation

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