T M S C A M I D D L E S C H O O L

S C I E N C E

T E S T # 1 ©

O C T O B E R 2 3, 2 0 2 1

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, lnx, 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 ± 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.

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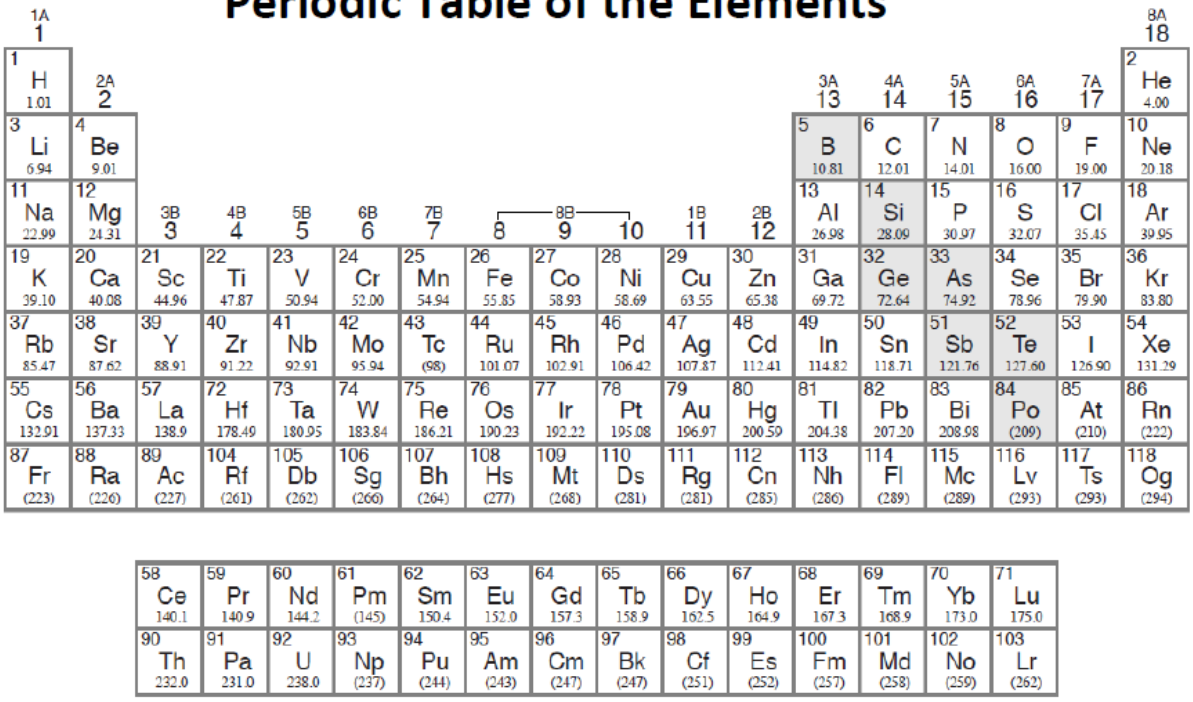
Periodic Table of the Elements



1A 1												3A 13	4A 14	5A 15	6A 16	7A 17	8A 18
1 H 1.01	2A 2																2 He 4.00
3 Li 6.94	4 Be 9.01											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	3B 3	4B 4	5B 5	6B 6	7B 7	8B 8	8B 9	8B 10	1B 11	2B 12	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
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 65.38	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
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 138.9	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 m/s^2
Avogadro's Number, N = 6.02 x 10^{23} molecules/mole
Planck's constant, h = 6.63 x 10^{-34} J•s
Planck's reduced constant, $\hbar = h/2\pi$ = 1.05 X 10^{-34} J•s
Standard temperature and pressure (STP) is 0°C and I atmosphere
Gram molecular volume at STP = 22.4 liters
Velocity of light, c = 3.0 x 10^8 m/sec
Absolute zero= 0 K = -273.15°C
Gas constant, R = 1.986 col/K•mole = 0.082 liter•otm/K•mole
One Faraday= 96,500 coulombs (9 .65 x 10^4 C)
Dulong and Petit's constant= 6.0 amu•col/gram•K
Electron rest mass, m_e = 9.11 x 10^{-31} kg
Atomic mass unit, m_u = 1.66 x 10^{-21} kg
Boltzmann constant, k_B = 1.38 x 10^{-23} J/K
Permittivity of free space ε_0 = 8.85 x 10^{-12} $C^2/N•m^2$
Permeability of free space $\mu_0 = 4\pi$ x 10^{-7} T •m/A
1 Atmosphere= 1.02 x 10^5 N/m^2 = 760 Torr = 760 mmHg
1 Electron Volt - 1.6 x 10^{-19} Joules
Charge of an electron = -1.6 x 10^{-19} coulombs (C)
1 horsepower (hp) = 746 W = 550 ft•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 J/g• °C

2021-2022 TMSCA Middle School Science Test #1

1. According to research, jumping spiders use "image defocus" to help them gauge the distance to pounce on their prey. This was discovered by testing how the spiders were able to catch prey by accurately estimating the distance in different wavelengths of light.
The researchers used green light and red light to see which would allow the spiders to successfully capture their prey.
What would be the dependent variable in this research project?

A. the color of the light used
B. the distance the spider could jump
C. capturing or not capturing the prey
D. the number of insects used as prey

2. The researchers found that spiders under green light could capture their prey successfully, but not under red light. What statement below is true?
A. Red light has a shorter wavelength than green light.
B. Green light damages retinas and red light does not.
C. Red light is not used for night vision and jumping spiders hunt at night.
D. Red light has a longer wavelength than green light.

3. Which of these is the brightest star in Earth's night sky?
A. Polaris B. Sirius C. Canopus D. Vega

4. Out of the following elements on the Periodic Table, which has the lowest density?
A. O B. Au C. He D. H

5. What is the cause of air pressure?
A. gravity pulling molecules in the atmosphere toward Earth
B. dust particles suspended in the air
C. wind
D. the change of temperature of falling objects to Earth

6. Which of the following is a natural satellite of Earth?
A. International Space Station B. Landsat C. the Moon D. the Sun

7. What is the chemical formula for propane?
A. C_3H_8 B. $C_6H_{12}O_6$ C. $C_6H_8O_7$ D. CO_2

8. The Hawaiian volcano, Mauna Loa, has low, gently sloped sides and usually has slow, gentle eruptions. What type of volcano is Mauna Loa?
A. cinder cone B. shield C. composite D. basaltic

9. The prefix "ign" is Latin with what meaning?
A. under B. begin C. fire D. death

10. The prefix “circum” is Latin with what meaning?
A. time B. around C. against D. both

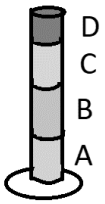
11. Look at this photo of a woodpecker. Which of the following would be on its food list?
A. insects B. crustaceans C. earthworms D. small mammals

12. What can happen to energy when it enters Earth’s atmosphere?
A. It is absorbed by Earth’s surface.
B. It is scattered by the clouds, gases, and ozone in the atmosphere.
C. It is reflected by the Earth’s surface and cloud cover.
D. All of these

13. Selena’s science class did a model activity in which they misted a globe model of the Earth with water and then sprinkled flour over it. One person stood by the globe and spun it in a counterclockwise direction while another person dripped water on the north pole area with an eyedropper. After spinning, the class could see that the water was deflected westward on the globe with the pattern in the flour. The purpose of this activity was most likely what concept?
A. Doppler effect
B. Doldrums
C. La Nina and El Nino
D. Coriolis effect

14. Which list shown below contains the prevalent gases found in Earth’s atmosphere?
A. radon, oxygen, caron dioxide
B. hydrogen, helium, nitrogen, water vapor
C. radon, methane, hydrogen, nitrogen
D. nitrogen, oxygen, argon, carbon dioxide, water vapor

15. Using this diagram, which statement below is true?
A. A is the least dense of the liquids
B. B is denser than A
C. C is denser than A and B
D. D is the least dense of the liquids



16. Which is a safe way to view a solar eclipse?
A. shade your eyes with your hand
B. use a special-purpose solar filter
C. use a pinhole viewer to view the sun indirectly
D. Both B & C

17. Which statement below is not true?
A. All planets revolve around the sun in the same direction.
B. An astronomical unit is the average distance of Earth's orbit around the sun
C. Earth is closest to the sun during Northern Hemisphere's winter.
D. Earth's atmosphere is composed mostly of nitrogen.

18. Christena found a green jelly-like substance on the ground near a rocky hill on a ranch. She later found out the substance was called "Nostoc" and is a cyanobacteria. What are cyanobacteria?
A. prokaryotic bacteria related microorganisms that can carry out photosynthesis
B. eukaryotic bacteria that is toxic to the soil
C. microorganisms that have membrane bound nuclei
D. a type of lichen that grow on hillsides in dry climates

19. An Olympic athlete ran the 100-meter race. He reached a velocity of 20 m/s in the direction west. The race was in a straight line on the track. What would be his average acceleration if his time for the race was 10 seconds?
A. 10 m/s^2 B. 20 m/s west C. 2.5 m/s^2 D. 2 m/s^2 west

20. Sarah saw an animal that was a lagomorph. Which of the following is not what she saw?
A. a placental mammal with two sets of gnawing teeth in the front of its upper jaw
B. a rabbit, a hare, or a pika
C. a type of herbivorous animal
D. a non-avian poikilotherm with a considerably long tail

21. A loggerhead shrike has a hooked bill, and carnivorous tendencies. It is a songbird, but behaves more as a raptor. Which of the following would it most likely eat?
A. grasshoppers, mice, lizards
B. worms, flies, ants
C. oranges, apples, avocados
D. seeds, fruits, insects

22. Which of the following statements is false when discussing chemical reactions?
A. The products are the substances that result from the change.
B. The reactants are the substances that undergo the change.
C. This symbol → stands for "energy"
D. Each symbol may have a coefficient is needed.

23. Name the element that has 50 protons and in group 4A on the Periodic Table.
A. Strontium B. Tin C. Antimony D. Selenium

24. Which statement about oxygen is true?
A. Air has more oxygen than water at the same temperature.
B. It is the 9th element on the Periodic Table.
C. Oxygen has an atomic mass of 8.
D. Oxygen makes up 30% of Earth's atmosphere.

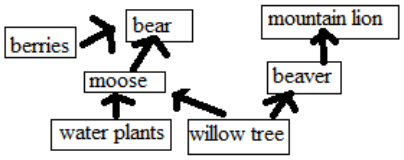
25. One of the earliest creators of the Periodic Table was Russian chemist named what?
A. Yuri Gagarin B. Dimitri Mendeleev C. Semenov D. Vladimir Putin

26. According to the Cornell Lab of Ornithology, this bird lives year round in the range shown on the map. Look at the photo of the woodpecker and the map. What type of woodpecker would this be?

A. Pileated woodpecker	Eastern and Northwestern forests
B. Acorn woodpecker	Western forests (with oak trees)
C. Ladder-backed woodpecker	Desert scrub and open forests
D. Red-cockaded woodpecker	Long leaf pine forests

27. When water in a spring boils and intermittently rises above ground in a column of water and stream, this is called what?
A. runoff B. subsidence C. geyser D. artesian well

28. According to this diagram, what labels would fit the mountain lion?
A. secondary consumer and carnivore
B. primary consumer and secondary consumer
C. secondary consumer and omnivore
D. producer and herbivore



29. When measuring "electrical resistance" in SI units, you should use what unit and symbol?
A. farad – F B. watt – W C. pascal – Pa D. ohm - Ω

30. What disease (that can be prevented now by a vaccine) did President Franklin D. Roosevelt suffer from that left him paralyzed?
A. polio B. rabies C. chicken pox D. smallpox

31. Which list below only contains heterotrophs?
A. zooplankton, phytoplankton, bacterioplankton
B. carnivore, omnivore, producer
C. mushroom, lion, eel
D. algae, lichens, house plant

32. In this disease, the human's immune system gradually breaks down the insulating material that surround nerve cells in the brain, spinal cord, and in nerves that lead from the eyes to the brain. What disease is this?
A. Multiple sclerosis B. Rheumatoid arthritis C. Measles D. Lupus

33. Membrane bound structures inside cells are known as what?
A. organisms B. tissues C. eukaryotes D. organelles

34. Which of the following is a list of organisms with compound eyes?
A. adult fleas, humans, spiders
B. dogs, wolves, coyotes
C. raccoons, baboons, sheep
D. house flies, horseshoe crabs, grasshoppers

35. Gathering data through observations and experimentation is what type of data?
A. theoretical B. anecdotal C. presumptive D. empirical

36. Which of the following would be found in the human brain?
A. nephrons B. hypothalamus C. pericardium D. alveoli

37. Antennae are found on most all insects. Which statement below correctly describes these structures?

A. appendages used as an ear on insects
B. appendages only used solely for touch receptors
C. a pair of extra appendages that can help insects communicate with other insects
D. a pair of sensory organs located on front of insect heads

38. The upper boundary of the zone of saturation is called what?
A. shadow zone B. the aeration field C. the water table D. aquifer

39. A stratus cloud that is close to ground level is also called what?
A. frost B. fog C. dew D. altostratus

40. Limestone and chalk are what type of rock?
A. metamorphic B. igneous C. sedimentary D. foliated

41. Sometimes water is called "hard" or "soft" because of the amount of what in them?
A. minerals B. microorganisms C. flakes D. ions

42. When trying to identify a mineral, which set of words below would most likely be used?
A. softness, color, texture, size
B. luster, streak, hardness, density
C. mass, acceleration, inertia
D. force, energy, motion position

43. Jane Goodall is to "ethologist" as James Hutton is to what?
A. geologist B. epidemiologist C. chemist D. botanist

44. Where do you look for specific instructions on safety for a chemical in the lab?
A. your teacher only B. MSDS C. CDC D. FDA

45. Which of the following is a list of pinnipeds?
A. orcas, dolphins, whale sharks
B. crabs, lobsters, crayfish
C. beetles, bugs, wasps
D. sea lions, walruses, seals

46. What fact about praying mantises is false?
A. They are predators.
B. The female will sometimes eat the male after mating.
C. They can turn their heads up to 180 degrees.
D. They give birth to live young.

47. The Greek word "planktos" means what?
A. flat B. person-like C. swimmer D. drifter

48. Hemoglobin molecule is built around the element Fe. What is chlorophyll built around?
A. Mg B. Mn C. C D. Cl

49. When a downdraft from a rain producing thunderstorm hits the ground and then spreads out in all directions, what is formed?
A. tornado B. gust front C. outflow boundary D. Both B and C

50. High energy particles from the solar wind get into the magnetosphere and become trapped within the Earth's magnetic field to produce what?
A. Oort cloud B. Van Allen belts of radiation C. Ionosphere D. Ephemeris

2021 - 2022 TMSCA Middle School Science Test #1- Key

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