TMSCA MIDDLE SCHOOL SCIENCE TEST #10 ©

FEBRUARY 8, 2020

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.

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	8	8B 9	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 al 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 Pelil's constant= 6.0 amu•cal/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 on electron"' -1.6 x 10^{-19} coulombs (C)
1 horsepower (hp) = 746 W = 550 ft•lb/s
Neutron Moss= 1.008665 au
Proton Mass= 1.007277 au
1 au= 931.5 MeV
1 calorie= 4.184 Joules (J)
Specific heal of water= 4.18 J/g• °C

2019-2020 TMSCA Middle School Science Test #10

1. The African Crested Rat has an interesting behavior. It chews the bark of a highly toxic tree and then rubs it on its specially adapted fur. This helps to protect it from predators. What would this behavior and the special fur be called?

   A. adaptation
   B. camouflage
   C. aposematic protection
   D. Both B and C

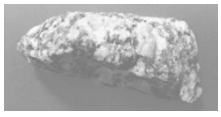
2. Complete this analogy: moon is to Earth as Phobos is to _____.
   A. Saturn B. Mars C. Jupiter D. Deimos

3. Which of the following plants is a hydrophyte?
   A. yucca B. prickly pear C. tomato D. duckweed

4. Which of the following is not a difference between plant and animal cells?
   A. A large central vacuole is found in plant, but not animal cells.
   B. Chlorophyll is found in plant, but not animal cells.
   C. Plant cells have cell walls, but not animal cells.
   D. Animal cells have a cell membrane, plant cells do not.

5. What is the name of this substance? $C_{12}H_{22}O_{11}$
   A. glucose B. fructose C. dextrose D. sucrose

6. Granite is a rock with fairly large crystals that forms underground when magma cools slowly. Granite can also include some naturally occurring radioactive elements that over time may decay into a harmful substance. This substance, a colorless, odorless, radioactive gas which can cause health problems such as lung cancer when it collects in homes. What is this substance?
   A. freon B. mica C. neon D. radon



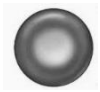
7. On the Mohs hardness scale, which of these minerals would be placed between fluorite and feldspar?
   A. apatite B. talc C. diamond D. topaz

8. Which statement below describes the theory of continental drift?
   A. the Earth's continents were once joined in a large landmass
   B. the landmass that made up the continents broke apart and drifted to the current locations
   C. Both A and B
   D. the magma below Earth's surface caused the continents to sink

9. 1 kilometer is approximately equal to 0.621 mile
Convert Earth's orbital velocity to miles per hour.
   A. about 75 mph
   B. about 17,000 mph
   C. about 34,000 mph
   D. about 67,000 mph

Planet	Orbital Velocity
Mercury	47.5 km/s
Venus	35.0 km/s
Earth	29.8 km/s
Mars	24.1 km/s
Jupiter	13.1 km/s
Saturn	9.6 km/s
Uranus	6.8 km/s
Neptune	5.3 km/s

10. Which blood type has only the A antigen on the red blood cells and the B antibody in the plasma?



   A. Group A B. Group B C. Group O D. Group AB

11. According to current science, which statement below would be correct?
   A. A radioactive isotope decays at different rates depending on the climate.
   B. The element used in radiometric dating is always Uranium.
   C. Radioactive dating allows scientists to assign an age to a rock or mineral.
   D. Certain isotopes are unstable and will release energy at unpredictable rates.

12. For a moving object to come to a complete stop, it must be what
   A. able to overcome the force of friction
   B. acted upon by an unbalanced force
   C. have the force that moved it discontinue
   D. have its inertia taken away

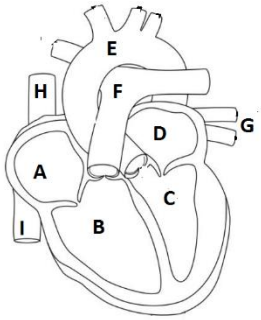
13. What does the prefix "sub" mean?
   A. under B. over C. beside D. above

14. Students in a Texas community have been testing water at their local pond. One of the tests they perform includes testing for E. coli bacteria. Recently, they observed an increase in population of feral hogs near their local pond. They wanted to find out if the hog population increase would affect the amount of E. coli in their testing. What would be a reasonable step in this investigation?
   A. stop testing for E. coli until the hogs go away
   B. start testing for other types of bacteria as well as E. coli
   C. set up a hog trap to remove the hogs from around the pond
   D. set up game cameras to keep track of the hog population around the pond

15. A saturated zone beneath the water table that is a storehouse for water is known as a what?
   A. watershed B. gradient system C. septic tank D. aquifer

16. The Ozone layer is found in what layer of the atmosphere?
    A. troposphere B. stratosphere C. mesosphere D. ionosphere

17. What is the name of the chamber labeled "D"?
    A. left atrium
    B. left ventricle
    C. right atrium
    D. right ventricle



18. Which of the lists below are perennials?
    A. carrots, potatoes, onions
    B. parsley, cabbage, onions
    C. okra, cucumbers, squash
    D. blueberries, rhubarb, asparagus

19. The catalytic converter in an automobile uses a catalyst to convert harmful substances into harmless compounds. Which item below is not one of the substances converted?
    A. hydrocarbons into water and carbon dioxide
    B. ozone into oxygen and water
    C. nitrogen oxides into nitrogen and oxygen
    D. carbon monoxide to carbon dioxide

20. Who in the early 1800s came up with a theory that proposed that all substances were made of atoms?
    A. Niels Bohr B. Gilbert Lewis C. John Dalton D. Robert Millikan

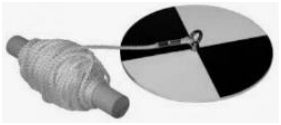
Common Name	Absolute Magnitude	Constellation
Rigel	-8.1	Orion
Betelgeuse	-7.2	Orion
Sirius	-1.46	Canis Major
Adhara	-4.8	Canis Major

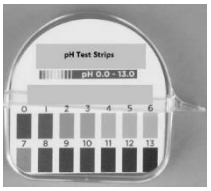
21. According to the absolute magnitude, which star in the chart is the brightest?
    A. Rigel B. Adhara C. Betelgeuse D. Sirius

22. Look at this list of terms below:
    Pacific, Nazca, Juan de Fuca, North American, Eurasian, Indo-Australian, South American
    Which statement below involving these terms is true?
    A. they are tectonic plates that form boundaries of the Ring of Fire
    B. divergent boundaries between tectonic plates
    C. they are boundaries of all the major oceanic currents
    D. they are names of rock types that form fault lines

23. Which of the tools below would be used to measure transparency in a body of water?

A. 

B. 

C. 

D. 
Rain gauge

24. Which statement about bronchitis is correct?
    A. it involves irritated and inflamed airways
    B. can be caused by an injury to the heart muscle
    C. it affects the kidneys and liver
    D. is not treatable

25. The branch of science that deals mainly with glands and the hormones they produce?
    A. immunology B. metamology C. pathology D. endocrinology

26. The prefix "ptero" means which of the following?
    A. finger B. large C. terrifying D. wing

27. Look at this diagram of a human skull. If the triangle represents the "fulcrum", what type of lever is represented by a person using muscles to move his/her head up?
    A. 1st class B. 2nd class C. 3rd class D. no lever is formed

28. Why is it important to calibrate instruments like probes before using them?
    A. calibration will ensure that the measurement taken will not have human error
    B. the measurement taken may not be accurate if the probe is not calibrated correctly
    C. the measurement will not be precise if not calibrated
    D. the probe will not work at all until it is calibrated

29. The 5th period science class wanted to find out how many drops of water they could put on a penny before the water overflowed. They took an eye dropper and added the drops one at a time while counting each drop. Surprisingly, the penny held much more than they predicted. Why do the water droplets stay together so well?
    A. they don't stay together very well – the penny was the key
    B. electromagnetic property
    C. high specific heat
    D. surface tension for the water is strong

30. A tornado that forms over water it is called a what?
    A. wind shear B. water devil C. water spout D. storm surge

31. Which of the following is an omnivore?
    A. jaguarundi B. beaver C. skunk D. ocelot

32. Samuel rode his bike a distance of 100 km in a local bike ride. He finished the ride in 4 hours and 15 minutes. What was his average speed? (to nearest tenths place)
    A. 24.0 km/h B. 2.6 km/h C. 4.3 km/h D. 23.5 km/h

33. All of the following statements are true except for which one?
    A. The vernal equinox starts the beginning of spring in the northern hemisphere.
    B. The same side of the moon faces the Earth as it revolves around.
    C. The Earth has a 23.5 degree tilt on its axis.
    D. Summer occurs when the Earth is closest to the sun in its revolution.

34. Where in the human body would you find the navicular bone?
    A. next to the talus bone B. in the knee C. in the hand D. upper arm

35. The branch of chemistry called "organic chemistry" involves mainly molecules of what element?
    A. Silicon B. Hydrogen C. Carbon D. Oxygen

36. Complete this analogy – "post office" is to a "town" as "_____" is to a "cell"
    A. nucleus B. mitochondrion C. Golgi body D. endoplasmic reticulum

37. What is the best explanation of absolute zero?
    A. zero on the Celsius scale in which particles are in absolute motion
    B. the equal to 0 on the Centigrade temperature scale
    C. the point in which water will evaporate absolutely
    D. zero on the Kelvin scale in which motion of particles would be minimal

38. Clues: American astronaut, first American in space, also walked on moon
    Who is this person?
    A. Alan Shepard B. Edwin Aldrin C. Ed White D. Neil Armstrong

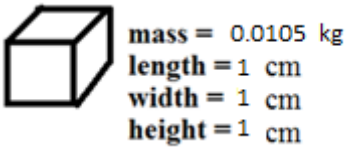
39. When tectonic plates move away from each other they are called what?
    A. divergent B. convergent C. subduction D. transform

40. Which of the following matches the integumentary system?
    A. skin, hair, nails
    B. spinal cord, neurons, brain
    C. bones, ligaments, cartilage
    D. legs, arms, fingers

41. What model theory helps scientists predict the geometry of molecules?
    A. heptane law B. noble law C. VSEPR theory D. Octet rule

42. Which of these elements below is considered to be an alkali metal?
    A. Titanium B. Mercury C. Cobalt D. Cesium

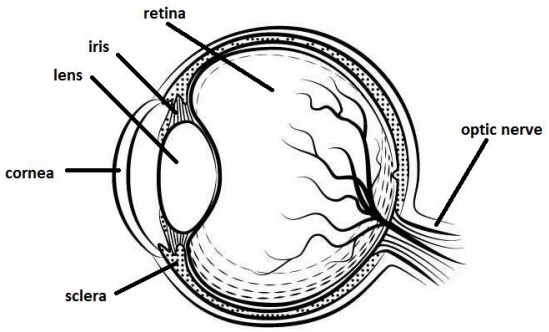
43. The density of pure silver is 10.5 g/cm$^{3.}$ Is it possible that this cube is silver? (a pure element)
    A. no, the density is too low
    B. no, the density is too high
    C. yes, the density is the same
    D. no way to tell with this information



44. Cumulus clouds look like which of the following?
    A. wispy, thin curls
    B. thin, flat sheets
    C. a UFO (flying saucer)
    D. puffy with flat bottoms

45. Which of these in the visible light spectrum has the longest wavelength?
    A. red B. blue C. yellow D. violet

46.



Which part of the eye would contain the rods and the cones?
    A. retina B. iris C. cornea D. sclera

47. The anterior cruciate ligament is also known as the what?
    A. ACL
    B. the radial collateral ligament
    C. the tendon that connects muscle to femur
    D. Both B and C

48. Jenny noticed that every time she goes up the steps to the third floor of her school, her heart beats faster. When she gets to her class on the third floor and sits down in at a desk, before long her heart is back to its normal heart rate. Jenny wants to conduct an experiment to find out if athletes or non-athletes have a faster heart recovery rate after walking up stairs. What would be a reasonable hypothesis for this experiment?

A. H_1 – Non-athletes will have a faster heart rate while going up the stairs.
B. H_1 - Athletes will have a faster heart rate while going up the stairs
C. H_1 - The recovery heart rate will be slower.
D. H_1 - Athletes have a faster heart recovery rate than non-athletes after walking up stairs.

49. What order should Jenny follow of the following steps to conduct this experiment?

Step Q - Take and record the resting heart rates of each participant
Step R - Take and record the heart rate of each participant after walking up the stairs.
Step W - Calculate recovery heart rate and record, then compare.
Step T - Determine if the participant is an "athlete" or "non-athlete" with pre-determined criteria
Step M - Continue to record the heart rate every 1 minute for each participant after walking up the stairs until the heart rate returns to resting heart rate.
Step U - Get permission and information for each the study participants

A. Q, U, T, M, W, R
B. U, T, Q, R, M, W
C. Q, T, U, W, R, M
D. U, Q, R, T, M, W

50. What is a very important skill that Jenny will need to learn before conducting this experiment?
A. how to calculate the average of heart rates
B. to know how a heart pumps blood
C. how to calculate a paired samples t test
D. how to properly and consistently take the radial pulse of a participant

2019 - 2020 TMSCA Middle School Science Test #10 - Key

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