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 # 3 ©

N O V E M B E R 2, 2 0 1 9

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)

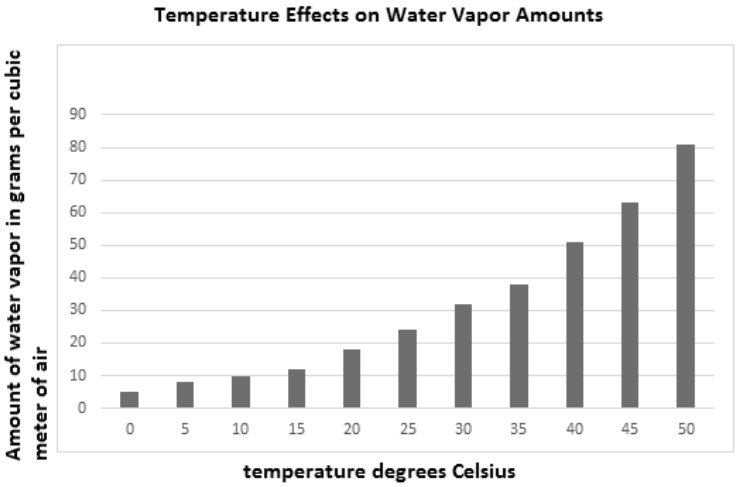
58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 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 #3

1. According to this graph, what statement below would be true?



A. When the temperature increases from 20 to 40^0 C, the grams of water vapor in one cubic meter of air increases only by 10 g.
B. When the temperature increases from 20 to 40^0 C, the grams of water vapor in one cubic meter of air increases by 30 g.
C. When the temperature increases from 5 to 40^0 C, the grams of water vapor in once cubic meter of air increases only by 20 g.
D. When the temperature increases, the amount of water vapor in the air decreases.

2. Which statement below about the water table is not true?
   A. The water table stays the same consistently.
   B. When it rains more, the water table rises.
   C. When there is a drought, the water table falls.
   D. The water table is at the surface of the zone of saturation.

3. What can cause a tsunami?
   A. earthquakes
   B. volcanic eruptions near water
   C. landslides into water bodies
   D. all of the above

4. Joey was roasting a marshmallow over a campfire using a wire clothes hanger bent straight. While he was holding it over the fire, he noticed that his hand could eventually feel the heat. He had to get a piece of a towel to hold the end so his fingers wouldn't get burned. Which statement below explains what happened?
   A. the heat from the fire used radiation to reach his fingers
   B. the heat from the fire used convection to reach his fingers
   C. the heat from the fire used conduction to reach his fingers
   D. the wire he was using was a great insulator which is why he felt the heat

5. According to current science, which statement below would be incorrect?
    A. A radioactive isotope decays at the same rate.
    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.

6. What color is human blood?
    A. red when it is outside of the body and blue when on the inside
    B. human blood is red because of the oxygen and the iron-rich hemoglobin
    C. only red when you bleed, on the inside it has no color
    D. mostly red, but sometimes black when it is full of nutrients

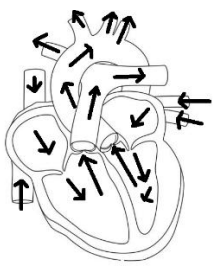
7. Lee was concerned about the number of calories in different types of cheese. He made a table and then wanted to see how many joules each would equal.
    (use the useful information chart as needed)
    What would an ounce of Cheddar have in Joules?
    A. 472.792
    B. 414.216
    C. 472,792
    D. 414,216

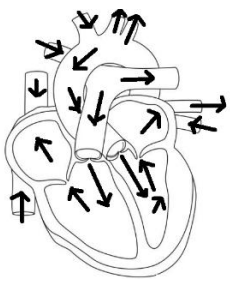
Cheese Type	**Number of kilocalories**	**Joules (J)**
Feta	74 per ounce	309,616
Mozzarella	84 per ounce	?
Blue Cheese	99 per ounce	414,216
Cheddar	113 per ounce	?

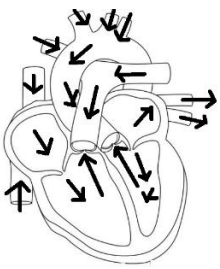
8. Which of the following is not true about minerals?
    A. Minerals are naturally occurring.
    B. Minerals have a crystal structure.
    C. Minerals are solid at room temperature.
    D. Minerals are only made of one element.

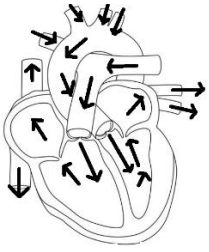
9. Scientists consider which of the following statements is true?
    A. Turtles will eat all the fish in a pond so that none are left.
    B. Turtles in a pond will "out compete" the fish for food.
    C. Turtles in a pond destroy the water quality and cause major problems.
    D. Most turtles have a homing instinct.

10. Which diagram below shows the correct movement of the blood through the heart?

A. 

B. 

C. 

D. 

11. The alula plant in Hawaii was put on the endangered species list when its numbers declined. Which of the following would cause the decline?
    A. people bringing in goats, pigs, and rats that eat the plants
    B. introduction of new plants in the areas it grows
    C. the decline in the green sphinx moth that pollinates the plant
    D. all of the above

12. Clues: cell, has a nucleus, has organelles that carry out specific activities for cell, example- plant cell What type of cell is this?
    A. eukaryotic cell B. vesicles C. prokaryotic cell D. cilia

13. What element is very abundant in the Earth's crust, but not so abundant in a human body? (It has an atomic mass of about 28.)
    A. Nickel B. Oxygen C. Phosphorus D. Silicon

14. Fred was tardy to chemistry class. When he sat down, he heard the teacher say "same number of protons, but different number of neutrons". What should Fred assume the teacher was talking about?
    A. actinides B. reagent C. rare earth metals D. isotopes

15. In geology, crystal means what?
    A. a very valuable gemstone that are very rare
    B. extremely clear and pure glass
    C. a solid with a symmetrical, ordered, 3-D arrangement of atoms or molecules
    D. a solid with no symmetrical order, but a unique arrangement of atoms

16. Which formula could be used for finding average acceleration?
    A. a= (distance/time)
    B. a = (change in velocity/change in speed)
    C. a = (change in velocity/change in time)
    D. none of these

17. Early astronomers named the dark areas on the moon what because they looked like seas?
    A. Oceania B. swells C. Atlantic D. Maria

18. A contact force between the car tire and the road that it rides on is called what?
    A. friction B. compression C. tension D. normal

19. When studying geology, students will learn of a theory that explains that what happens to Earth in the present is the key to what happened in the past. In other words, processes shaping the planet remain constant throughout natural history. This is known as what?
    A. The Law of the Land
    B. Catastrophism
    C. Continental Drift
    D. Uniformitarianism

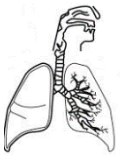
20. A Mercedes car has some really interesting "blue" headlights. This is because the headlights use this type of gas which also has an atomic mass of 131.
What element do these lights use?
A. Argon B. Xenon C. Neon D. Krypton

21. The prefix "neph" are related to what organ in the body?
A. heart B. lung C. kidney D. liver

22. Sometimes, an ancient living thing gets trapped in tree resin to form a fossil. The ancient tree sap that traps the living thing is called what?
A. cast B. mold C. amber D. petrification

23. "Rarefaction" is to "compression" as "potential" is to what?
A. movement B. acceleration C. energy D. kinetic

24. The sickness, RSV, that affects the respiratory system and is called?
A. respiratory syncytial virus
B. respiratory salivary virus
C. renal sickness varicella
D. respiratory sinus virus



25. Scientists who are studying ice core samples in Greenland to search for sulfur from historic eruptions use what tool?
A. anemometer B. dynamometer C. mass spectrometer D. specialized caliper

26. The most common component of sand is what?
A. volcanic ash
B. carbon dioxide in solid form
C. mica with organic material
D. silicon dioxide as quartz

27. The land area that channels rainfall and/or snowfall to creeks, streams, and rivers to a particular water storage place is called a what?
A. watershed B. gradient system C. hydrological source D. aquifer

28. The weather has been interesting the last couple of days. The temperature was warm outside with winds out of the South. The winds changed so that they came out of the North and then thunderstorms formed that brought some heavy rains for a short period of time. Afterwards, the sky began to clear and the temperature outside was much cooler. What type of front came through this area?
A. warm front B. cold front C. occluded front D. both A and B

29. There are neutral subatomic particles with a mass close to zero that rarely interact with normal matter. According to scientists, these travel to Earth at nearly the speed of light and pass through the human body at the rate of about 100 trillion per second. What are they?
    A. quarks B. neutrinos C. electron D. proton

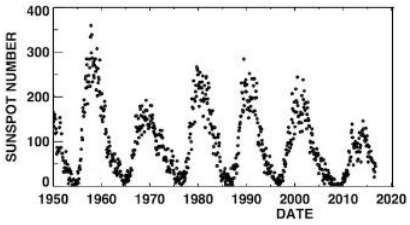
30. Which statement about planet Earth is untrue?

    A. Earth is the only planet with water.
    B. Earth takes about 365 days to revolve around the sun.
    C. Earth is about 40,000 km in circumference.
    D. Earth has a magnetic field.

31. What natural adaptation does Sargassum (seaweed) have to keep it afloat?
    A. attaches itself to buoys and man-made items
    B. collects plastic trash particles that float
    C. it does not float, it is too dense
    D. gas-filled bladders that look like "grapes"

32. Which of the following belong to the skeletal system?
    A. skin, hair, nails
    B. spinal cord, neurons, brain
    C. bones, ligaments, cartilage
    D. legs, arms, fingers

33. Using this NASA diagram of sunspots, what would be a reasonable prediction for sunspots in 2020?



    A. Sunspot numbers will jump to over 100.
    B. Sunspot numbers are unpredictable.
    C. Sunspots will be increasing to a point of approximately 300 during 2020.
    D. Sunspot number should be low, but will continue to rise in the following few years.

34. This chemical equation is not balanced. What coefficients are needed to make it balanced?

$$O_2 + CH_4 \rightarrow CO_2 + H_2O$$

    A. $O_2 + 2CH_4 \rightarrow 2CO_2 + H_2O$
    B. $3O_2 + CH_4 \rightarrow CO_2 + 2H_2O$
    C. $2O_2 + CH_4 \rightarrow CO_2 + 2H_2O$
    D. $1O_2 + CH_4 \rightarrow 1CO_2 + H_2O$

35. Which of these lists contain observations about the Cretaceous Period?
    A. first flowering plants, much formation of chalk, separated continents
    B. only amphibians, large areas of dry land, many volcanoes.
    C. first fish formed, first vertebrates. No land
    D. large areas of land and water, seed ferns, coniferous plants, first land dwelling reptiles

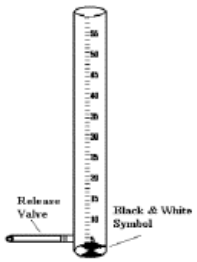
36. What is the difference between bioluminescence and biofluorescence?
    A. bioluminescence – organism's generation of light by a chemical reaction
       biofluorescence -absorption and then emission of light by organisms
    B. biofluorescence - organism's generation of light by a chemical reaction
       bioluminescence - absorption and then emission of light by organisms
    C. both involve emission of light, but biofluorescence involves only green pigment
    D. none of the above

37. Where in the human body would you find the talus bone?
    A. head B. foot C. hand D. calf

38. Clues: came from a very large family, born in Siberia, helped develop the Periodic Table of the Elements What person is this?
    A. Ivan Pavlov
    B. Isaac Newton
    C. Dimitri Mendeleev
    D. Konstantin Tsiolkovsky

39. In Australia, which constellation listed below is visible year-round on a clear night?
    A. Scorpius B. Leo C. Orion D. Southern Cross

40. A high school environmental science class does a monthly water test at a nearby stream. One tool that they use is a long clear tube in which you pour the water in and release it slowly until the black and white disk at the bottom can be seen clearly. This is used to measure turbidity. What would be the importance of taking this measurement?
    A. to determine water quality in relationship to suspended solids
    B. to find out if the aquatic animals can see where they are swimming
    C. to find out how much sunlight can penetrate the water to reach any aquatic plants for photosynthesis
    D. Both A and C



41. As you move from left to right on the Periodic Table of the Elements, the _____ increases.
    A. atomic number B. number of protons C. Both A and B D. only the atomic mass

42. Chicken Pox is caused by a what?
    A. bacteria B. virus C. chickens D. fungus

43. Sunspots go through a cycle of increasing amounts about every _____ years.
    A. 5 years B. 20 years C. 2 years D. 11 years

44. Most of the mass of an atom is in the what?
    A. electrons B. energy levels C. subatomic particles D. nucleus

45. Two friends were lifting a box into the back of a pickup truck. The first person reached down and lifted the box using a force of 450 N straight up from the ground into the bed of the truck which was 1 m of the ground. The second person used a 3 m board as a ramp and pushed the box up the ramp into the bed of the truck with a force of 150 N. Which person did more work?
    A. The first person did more work because he used more force.
    B. The second person did more work because she pushed the box a longer distance.
    C. They both did the same amount of work.
    D. There is no way to tell with the information given.

46. Recently, scientists have been researching insect egg shapes. Data has been collected on the egg shapes, such as small and round, asymmetrical, and large round egg types. In addition, data has been recorded to where the insects lay the eggs and the amounts.
Which is not a variable in this investigation?
    A. number of insect eggs found at each place
    B. different shapes of insect eggs
    C. location eggs are found
    D. number of amphibian eggs found

47. Calculate the density of this cube.
What is the density?

mass = 3 kg
length = 5 cm
width = 5 cm
height = 5 cm

    A. 0.024 g/cm^3
    B. 41.6 g/cm^3
    C. 375 kg/ cm^3
    D. 24 g/cm^3

48. Use this table to answer the following question.
If a person at sea level blows a whistle on a day when the temperature was freezing and then blows it again when the temperature was 20 deg. C., the sound waves from the whistle will what?

Temperature of Air (at sea level) for temperature of ^{0}C	**m/s**
0	331.5
20	343
100	386

    A. travel slower on the 20 deg. C. day
    B. travel faster on the 20 deg. C. day
    C. travel the same speed regardless of the temperature
    D. travel faster on the 0 deg. C. day

49. What part of a cell is known as the "recycler" of the cell parts?
    A. lysosomes B. vacuoles C. mitochondria D. ribosomes

50. The SI base unit for measuring mass is what?
    A. gram B. ton C. ounce D. kilogram

2019 - 2020 TMSCA Middle School Science Test #3 - Key

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