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 # 6 ©

D E C E M B E R 1 0 , 2 0 2 2

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 keys 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																	8A 18
1 H 1.01	2A 2											3A 13	4A 14	5A 15	6A 16	7A 17	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, $N = 6.02 \times 10^{23}$ molecules/mole

Planck's constant, $h = 6.63 \times 10^{-34}$ J•s

Planck's reduced constant, $\hbar = h/2\pi = 1.05 \times 10^{-34}$ J•s

Standard temperature and pressure (STP) is 0°C and I atmosphere

Gram molecular volume at STP = 22.4 liters

Velocity of light, $c = 3.0 \times 10^8$ 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 (9.65×10^4 C)

Dulong and Petit's constant= 6.0 amu•col/gram•K

Electron rest mass, $m_e = 9.11 \times 10^{-31}$ kg

Atomic mass unit, $m_u = 1.66 \times 10^{-21}$ kg

Boltzmann constant, $k_B = 1.38 \times 10^{-23}$ J/K

Permittivity of free space $\varepsilon_0 = 8.85 \times 10^{-12}$ C^2/N•m^2

Permeability of free space $\mu_0 = 4\pi \times 10^{-7}$ T •m/A

1 Atmosphere= 1.02×10^5 N/m^2 = 760 Torr = 760 mmHg

1 Electron Volt - 1.6×10^{-19} Joules

Charge of an electron = -1.6×10^{-19} coulombs (C)

1 horsepower (hp) = 746 W = 550 ft•lb/s

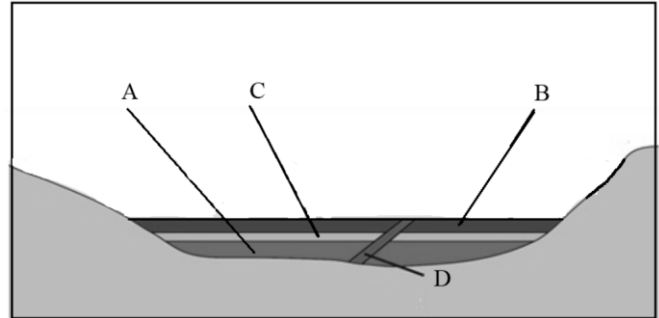Neutron Mass= 1.008665 au

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

1. In this diagram, following the progression of geologic time, what order did these layers happen?
A. first layer A, then B, then C, then D last
B. first layer D, then C, then B, then A last
C. first layer A, then C, then B, then D last
D. first layer B, then C, then A, then D last

2. Which statement below is true about lampreys?
A. They have changed a lot over the last 330 million years.
B. They only live in saltwater exclusively.
C. They live in shallow ponds.
D. They are jawless.

3. Io, Ganymede, Callisto, and Europa have something in common. They all what?
A. orbit at the same speed around Saturn
B. rotate once on their axis for every orbit around Jupiter
C. are composed of 95% ice and 5% rock
D. are part of the asteroid belt

4. Michael's group was dissecting a frog in class. When they pulled out the digestive system, they needed to identify the parts of the digestive system in order. Which list below shows the correct order starting with the mouth?
A. gullet opening, pylorus, esophagus, stomach, colon, small intestine, rectum, cloaca
B. gullet opening, stomach, pylorus, esophagus, colon, small intestine, rectum, cloaca
C. gullet opening, small intestine, colon, pylorus, rectum, cloaca, stomach, esophagus
D. gullet opening, esophagus, stomach, pylorus, small intestine, colon, rectum, cloaca

5. In this Punnett square, what would the percentage of offspring that would have a heterozygous genotype?
A. 25%   B. 50%   C. 75%   D. 100%

		Maternal	
		B	b
Paternal	B	BB	Bb
	b	Bb	bb

6. A PCR test which uses a biochemical process is short for what?
A. polymerase chain reaction
B. penny circuit response
C. polysaccharide chemical reaction
D. phenotype carbon response

7. The Cambrian Explosion refers to what?
A. a bomb that was set off at a canyon for mining purposes
B. an emergence of abundant life forms on Earth around 530 million years ago
C. a volcanic eruption that took place during Cenozoic time.
D. the big bang that started the universe is also called this

8. Which of the following animal is considered a monotreme?
A. kangaroo　　　　B. kiwi　　　　　　C. platypus　　　　D. wombat

9. What would be the best word to fill in this blank?
Humans are composed of about 37 _____ cells.
A. million　　　　　B. billion　　　　　C. trillion　　　　　D. quadrillion

10. Unicellular or Multicellular?　amoeba, E.coli, and people
A. amoeba – unicellular　　E. coli – multicellular　　people – multicellular
B. amoeba – unicellular　　E. coli – unicellular　　people – multicellular
C. amoeba – multicellular　E. coli – multicellular　　people – unicellular
D. amoeba – unicellular　　E. coli – multicellular　　people - unicellular

11. A scientist who is studying spiders and how they use their web to pick up vibrations from prey most likely would be called a what?
A. ichthyologist　　B. herpetologist　　　C. mycologist　　　D. arachnologist

12. If the fluid outside a cell is this, then water diffuses out of the cell and the cell shrinks. What would this outside fluid be?
A. hypertonic　　　B. hypotonic　　　　C. isotonic　　　　D. none of these

13. This formula summarizes what process?
$3CO_2 + 3 H_2O$　light　$C_3H_6O_3 + 3O_2$

➡
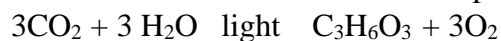
A. cellular respiration　　B. photosynthesis　　C. mitosis　　D. osmosis

14. What person from the past bred varieties of the garden pea to learn more about heredity?
A. Gregor Mendel　　B. Robert Hooke　　　C. Alfred Wallace　D. Rachel Carson

15. If the circle on the right represents Earth, what planet does the circle on the left represent according to the size comparison?
A. Jupiter　　B. Mercury　　　　C. Venus　　　D. Moon
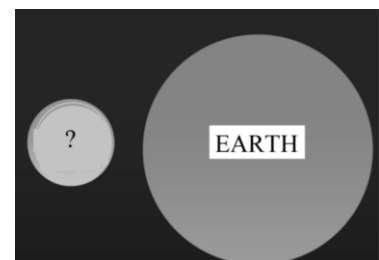
16. Planet Facts: 1) has two moons 2) atmosphere is mostly CO_2 3) 142 million miles from sun
Name that planet!
A. Mercury   B. Uranus   C. Mars   D. Jupiter

17. What does it mean when a mineral is fluorescent?
A. reflects light and appears to glow
B. absorbs green or yellow light only
C. contains the mineral fluorine
D. emits visible light when exposed to external radiation

18. For life to thrive on a planet, there needs to be what?
A. liquid water   B. carbon   C. source of energy   D. all of these

19. About how long is an Earth day because of its rotation?
A. 365 days   B. 24 hours   C. 52 hours   D. 7 days

20. What direction does the Earth rotate when looking from the North pole?
A. prograde   B. counterclockwise   C. clockwise   D. Both A and B

21. Which of the following labels is correct for
the diagram on the right?

A. A-mantle B- crust   C-inner core   D-outer core
B. A-crust   B-mantle   C-outer core   D- inner core
C. A-crust   B-outer core C-inner core   D- mantle
D. A-crust   B-inner core C-mantle   D- outer core

22. The brightly colored parts of a hibiscus flower used
to attract pollinators are called what?
A. sepals
B. petals
C. pistils
D. stamens

23. Which of the following is an important factor used to determine the rating of a tornado?
A. moisture levels
B. depressions
C. how long it took to form
D. the damage it caused

24. A chemical reaction in which a substance gains one or more electrons is called what?
(is paired with another reaction in which the electron(s) are lost)
A. oxidation   B. reduction   C. condensation   D. precipitation

25. What is the dewpoint? (with constant pressure and water content)
A. temperature that the air is when water freezes
B. temperature that the air must be cooled for water vapor to be 100%
C. temperature that the air must be heated to for evaporation to occur
D. temperature of cooled air when clouds are not able to form

26. In a food chain that shows the transfer of energy, the arrows point in the direction of what?
A. what is being eaten (the giver of energy)
B. what is eating the organism (the receiver of the energy)
C. the arrows are not important and can point either way
D. the arrows only point to the bigger animals

27. An area was a temperate forest biome before a volcano erupted. The lava from the volcano
destroyed the forest and brought it back to a state of hardened lava rock. What ecological state
would come next?
A. primary succession   B. secondary succession   C. climate community   D. tundra

28. Hemiptera is the Order for 'true bugs". What does the word "hemiptera" mean?
A. half-leg: which refers to the size of the legs
B. part-body: which refers to the shape of the body
C. half-wing: which refers to the differences in the wing parts
D. earth-flight: which refers to the mode of travel

29. Which of the following would not be a function of the pancreas?
A. secreting enzymes into the digestive tract
B. producing lipase, protease, and amylase
C. secreting hormones that control blood sugar levels
D. fighting invading germs in the blood

30. The root word "pulmo" is related to what organ in the body?
A. heart   B. lung   C. kidney   D. liver

31. What was the publication year of "*On the Origin of Species*" by Charles Darwin which
describes the theory of evolution?
A. 1359   B. 1459   C. 1759   D. 1859

32. If Vivian found a blister beetle for her project, what Order would it go in?
A. Orthoptera Order
B. Lepidoptera Order.
C. Hymenoptera Order.
D. Coleoptera Order.

33. Ryan was curious about weather and decided to investigate precipitation. Overnight in Ryan's backyard, it snowed 3 inches on January 8. Ryan did a core sample of the snow and then melted it down carefully to see how much water the snow amount would equal. While researching, he found out that 13 inches of snow will average to equal 1 inch of water. A week later after the previous snow had melted, it snowed again, but this time the measurement was 17 inches. Again, Ryan took a core sample and melted down the snow into liquid water and measured the liquid in his rain gauge. Each time, Ryan recorded his findings. Which table below would most likely be Ryan's data table?

A.

Date	Snow inches	Melted Core inches
Jan. 8	3	3
Jan. 15	17	17

B.

Date	Snow inches	Melted Core inches
Jan. 8	3	5
Jan. 15	17	23

C.

Date	Snow inches	Melted Core inches
Jan. 8	3	.23
Jan. 15	17	1.31

D.

Date	Snow inches	Melted Core inches
Jan. 8	3	1.31
Jan. 15	17	.23

34. Jimmy left a pan on the stove (turned off) over a span on one week. When he checked the pan of water, he noticed that there was not as much water in the pan now than when he left it. What happened to the water in the pan?
A. Jimmy probably didn't measure the water right to begin with and no water left the pan.
B. Water in the pan evaporated into the air over time.
C. Water in the pan condensed and caused less water.
D. The air in the room needed more water and pulled it out of the pan.

35. In a model of an atom, where would you find a neutron?
A. orbiting the outside
B. in the middle layer close to the electrons
C. in the center of the atom called the nucleus
D. in the electron cloud

36. How many elements make up baking soda? ($NaHCO_3$)
A. 1   B. 2   C. 3   D. 4

37. A type of bond in which atoms share one or more electrons is called what?
A. ionic   B. covalent   C. coagulant   D. both A and C
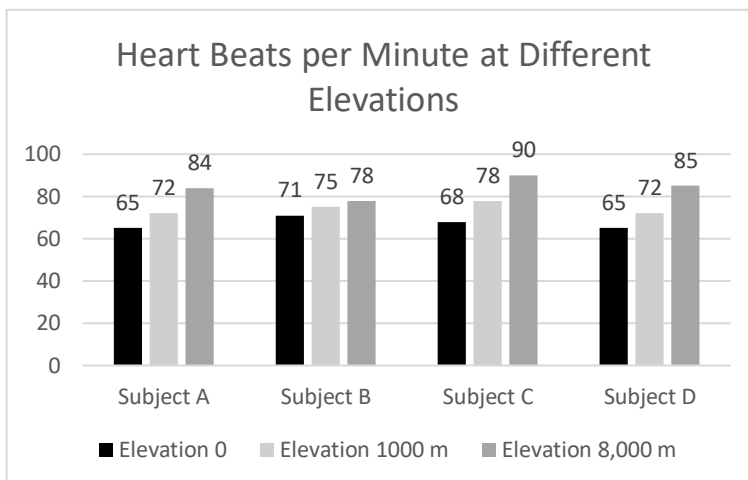
38. What element on the Periodic table has an atomic mass of 91.224?
A. Zirconium   B. Protactinium   C. Cesium   D. Niobium

39. If Jasmine was riding her skateboard and hit a curb. The skateboard stopped and she continued to move forward until she fell. What law of motion describes what happened here?
A. Newton's first law of motion
B. Newton's second law of motion
C. Newton's third law of motion
D. No laws of motion apply to this

40. Larry wanted to test the heartbeats of 4 people at different elevations to see if elevation affected their heartbeat rate. He had each person sit motionless in a chair for 5 minutes before measuring their heart rate. These are Larry's results.

Heart Beats per Minute at Different Elevations

Subject	Elevation 0	Elevation 1000 m	Elevation 8,000 m
Subject A	65	72	84
Subject B	71	75	78
Subject C	68	78	90
Subject D	65	72	85

According to this chart, what elevation seems to have increased the heart rate of the subjects in the investigation?
A. there was no difference   B. 0 m   C. 1,000 m   D. 8,000 m

41. What is the independent variable in Larry's investigation?
A. the amount of time they sat in the chair
B. the heartbeat rate
C. the elevation
D. the number of people that Larry tested

42. What was the average heartbeat rate for all 4 subjects at the 8,000 m elevation?
A. 84.5   B. 84.25   C. 85   D. 78

43. Was the average heartbeat rate for 1,000 m elevation more than the average heartbeat rate for 8000 m elevation (for all 4 subjects)?
A. Yes, it was 3 beats higher
B. Yes, it was 10 beats higher
C. No, it was 3 beats lower
D. No, it was 10 beats lower

44. The random movement of microscopic particles suspended in a fluid is called what?
A. Roombaism   B. protonic suspension   C. Brownian motion   D. the energy shells

45. What can change the speed or direction of an object's motion?
A. vector   B. velocity   C. an unbalanced force   D. magnitude of energy

46. Which of the following is a rare earth metal?
A. Nd   B. He   C. Ne   D. Pb
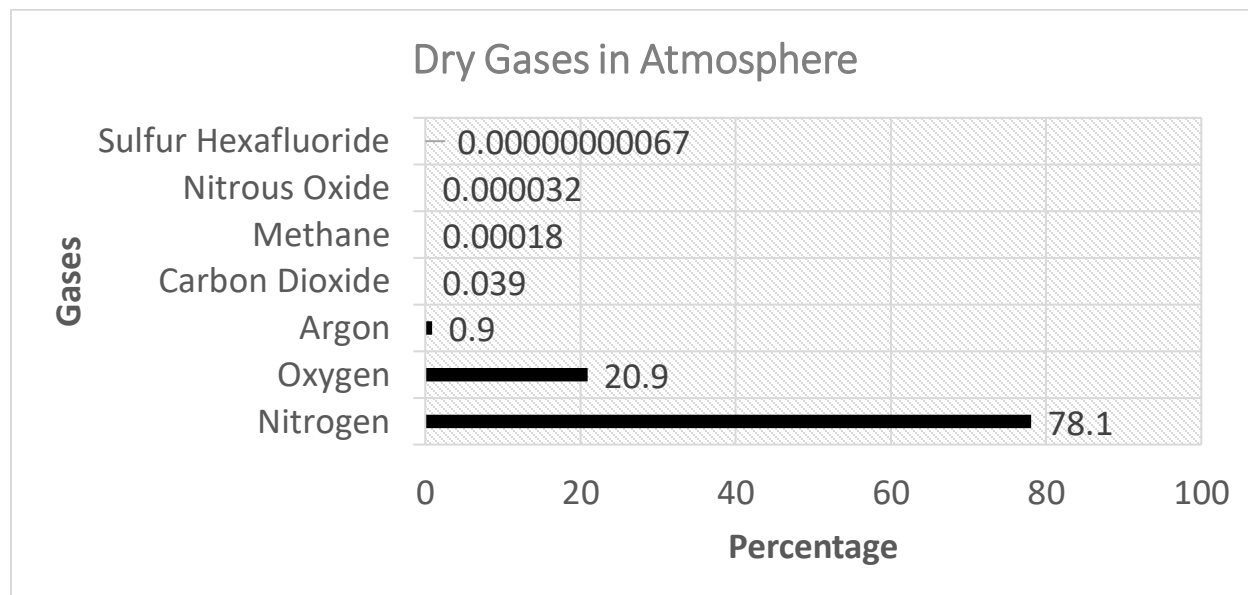
47. Which of the following is a nonmetal?
A. Nitrogen   B. Iron   C. Aluminum   D. Boron

48. Which of the following are used commonly in high-tech devices such as cell phones, computer hard drives, and other modern technology?
A. hydrogen
B. noble gases
C. rare earth metals
D. halogens

Dry Gases in Atmosphere

Gases	Percentage
Sulfur Hexafluoride	0.00000000067
Nitrous Oxide	0.000032
Methane	0.00018
Carbon Dioxide	0.039
Argon	0.9
Oxygen	20.9
Nitrogen	78.1

49. The graph above displays the percentages of dry gases in Earth's atmosphere. What two make up most of the atmosphere?
A. Sulfur Hexafluoride and Nitrous Oxide
B. Oxygen and Nitrogen
C. Methane and Carbon Dioxide
D. Argon and Oxygen

50. According to this graph, which statement is true?
A. There is more Sulfur Hexafluoride than Nitrous Oxide in the atmosphere.
B. Carbon Dioxide makes up more than 5% of the atmosphere.
C. Methane gas is higher than Carbon Dioxide levels.
D. Nitrogen makes up more than all the others combined.

2022 - 2023 TMSCA Middle School Science #6 Test - Key

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