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

S C I E N C E

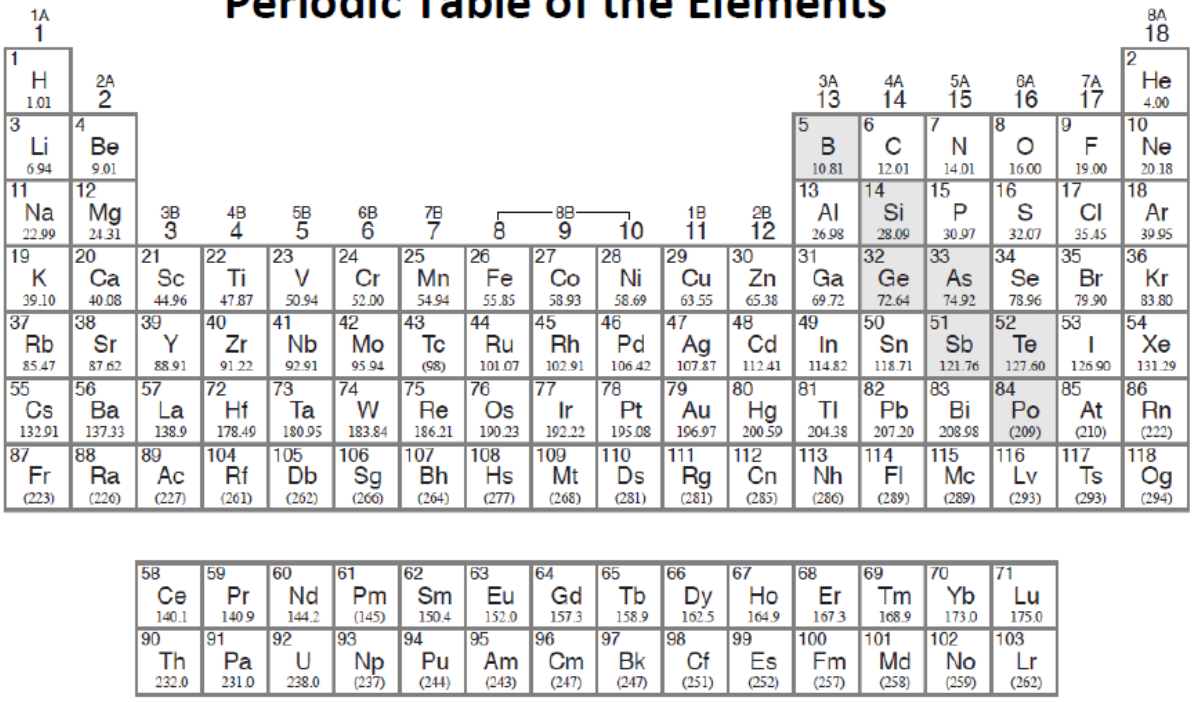
T E S T # 2 ©

O C T O B E R 2 9 , 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.

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	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

2022-2023 TMSCA Middle School Science Test - #2

1. Jennifer was doing an investigation. She set up a glass with a cold carbonated beverage in it. She put two raisins in the glass. Next, she observed what happened to the raisins in the glass. Her notes are to the right.

Notes -

Two raisins seem to be collecting bubbles on the sides.
Raisin #1 floats to the top of the glass.
Raisin #1 sinks to the bottom of the glass.
Raisin #2 does the same thing!
Raisins continue to rise and fall in the glass.

Which explanation below would be most reasonable for Jennifer to explain what happened in the investigation?

A. The chemical reaction taking place causes the raisins to rise and sink. Continuous chemical reactions take place causing the raisins to rise and fall over again.
B. The CO_2 in the beverage is very active which causes the raisins to move around.
C. The raisins collect bubbles of CO_2 from the liquid which make them less dense, so they rise to the top. At the top, the CO_2 is released into the air so the raisins sink.
D. The raisins get warm as they sit in the liquid. Hot things rise. Then they cool off and sink.

2. Jennifer's investigation demonstrates what concept?
A. chemical reaction B. changes in buoyancy C. gravity D. frictional change

3. Jennifer wondered if using a fruit that doesn't have a wrinkled surface would change what happens in this investigation. She tried the same thing using two grapes instead of raisins. What would be a reasonable prediction of what would happen?
A. The grapes will collect CO_2 on the sides and will rise and fall as the grapes did.
B. Because grapes are round, they will only float, not sink.
C. Gravitational pull will be different because the mass is different.
D. The grapes will chemically react with the carbon dioxide.

4. The science teacher took a "slinky" and demonstrated a wave movement by pushing and pulling the slinky. The displacement of the wave is the same as the direction of the wave. What type of wave was the teacher demonstrating?
A. longitudinal wave
B. centripetal wave
C. amplitude wave
D. transverse wave

5. What would be an example of how Pascal's principle is used in real life?
A. drinking from a straw
B. cartesian diver experiment
C. using a cue ball to hit another ball on a pool table
D. the hydraulic breaks in an automobile

6. Chad noticed three patches of sunflowers growing in his backyard. He wanted to ask this question – what is the best way to water the sunflowers? He made a note of how each patch received the same amount of sunlight and were growing in the same type of soil. He measured and recorded the height of the plants in each patch. Next, he set a watering schedule for each patch. **Patch #1** got watered for 10 minutes each evening for 1 week. **Patch #2** got watered for 10 minutes every 3 days. **Patch #3** did not get watered at all for week of his study. He planned on measuring the plants each day in the morning for the week. What would be the dependent variable in his investigation?

A. the amount of water each patch of sunflowers received
B. the amount of rainfall that falls during the two weeks
C. the number of flowers that were in each patch
D. the amount of growth each plant makes

7. Chad recorded the data for sunflower patch #1 for the week in the diagram below.

Sunflower Patch #1	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Total growth
Plant A	8 cm	8 cm	8.5 cm	8.5 cm	9 cm	9 cm	9 cm	9.5 cm	1.5
Plant B	6 cm	6 cm	6.4 cm	6.5 cm	6.5 cm	7 cm	7 cm	7 cm	?
Plant C	10 cm	10 cm	10 cm	10.5 cm	10.5 cm	11 cm	11 cm	11 cm	?
Plant D	7 cm	7 cm	7.5 cm	7.5 cm	7.5 cm	8 cm	8 cm	8 cm	?
Plant E	5 cm	5 cm	5.5 cm	5.5 cm	6 cm	6.5 cm	7 cm	7 cm	2.0

For the week, what was the average amount of growth for Patch #1 flowers?

A. 6.5 cm B. 1.3 cm C. 2.0 cm D. 4.5 cm

8. If the average amount of growth of Patch #2 was 4.5 cm and Patch #3 was 0.5 cm, which patch of sunflowers had the greatest average amount of growth?

A. Patch #1 B. Patch #2 C. Patch #3 D. Both A and B

9. Which statement below would be a reasonable conclusion for Chad's investigation?

A. Patch #1 that was watered everyday showed the most overall growth.
B. Patch #2 that was watered every 3 days showed the most overall growth.
C. Patch #3 that was not watered at all showed the most overall growth.
D. The watering schedule had no effect on the growth.

10. Which statement below would be a recommendation that Chad could make to his neighbors about watering sunflowers based on his investigation?

A. Sunflowers don't need to be watered at all.
B. It's best to water your sunflowers and then wait a few days before watering again.
C. Sunflowers need to be watered every single day.
D. If you don't water your sunflowers for a week, they will die.

11. Which of the following items can be composted and turned into a natural fertilizer for a garden?

A. Styrofoam B. aluminum foil C. plastic bottles D. eggshells

12. This heron has a beak that is perfect for what?

A. feeding on nectar in flowers
B. splitting open fruits and nuts
C. breaking open seeds
D. catching crustaceans in water

13. A special set of points, identified by mathematician Joseph-Louis Lagrange in the 1700s, are in a place where the gravitational pull of the sun and the planet nearby are "balanced". A spacecraft can stay in one of these spots and have an advantage by being there. What is an advantage of being in this Lagrange point?

A. It is less likely to be found by space pirates.
B. It can stay there and not use very much of its fuel.
C. It does not have any advantage by being in the Lagrange point.
D. It can absorb more heat in that location and not get cold.

14. What are a few common characteristics of a mineral used for identification?

A. taste, smell, crushability, combustibility
B. cost, value, rareness, color
C. weight, mass, crystal, patterns
D. hardness, color, luster, streak

15. Antares, Betelgeuse, and KY Cygni are all what?

A. comets that have come within 10 km of Earth
B. stars in the Milky Way Galaxy
C. nebulae in the near universe
D. constellations found in the northern sky

16. Which statement about Mohs hardness scale is true?

A. Each number on the scale increases in hardness by 10 times
B. The scale was developed for industrial use because of its precision.
C. Mohs scale is a qualitative ordinal scale based on relative resistance.
D. The scale was named after an Italian inventor who used minerals in his creations.

17. Geologists use what to test rocks for the presence of calcium carbonate?

A. arsenic B. nitric acid C. cesium D. hydrochloric acid

18. Beetles belong to the Order Coleoptera. What does the word" coleoptera" mean?

A. colorful- wing B. false-body C. winged-body D. sheath-wing

19. The immature stage of an insect that looks like a smaller version of the adult is called a what?
A. larva B. nymph C. pupae D. caterpillar

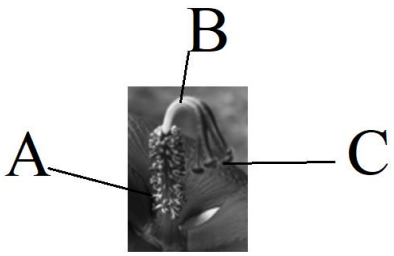
20. Where would you most likely find in the limnetic zone of a water body?
A. nekton B. plankton C. amphibians D. Both A and B

21. A graphic used to predict the results of a genetic cross is called what?
A. Genotype B. Phenotype C. Punnett square D. Allele

22. The external openings in an insect or arthropod that is used in respiration is called what?
A. spiracles B. mandibles C. siphons D. stamens

23. Which of the following shows the correct order of size from smallest to largest?
A. bacterium, red blood cell, virus, penny
B. virus, bacterium, red blood cell, penny
C. penny, red blood cell, bacterium, virus
D. bacterium, virus, red blood cell, penny

24. Look at the structure on this hibiscus flower. The part labeled "C" where pollen is collected is called what?
A. ovary
B. stamen
C. stigma
D. anther



25. Which of the following is not a characteristic of a desert biome?
A. low rainfall
B. variation in day and night temperatures
C. cool and moist air
D. drought resistant vegetation

26. What is necessary for evaporation of water to occur?
A. heat energy B. conduction C. negative charges D. the right dewpoint

27. A chemical that helps a chemical reaction happen more easily and quickly without actually being part of the reaction as a reactant or product is called what?
A. activator B. catalyst C. allotrope D. ion

28. What term is given to the species that is vitally important to an ecosystem so much so that if it was no longer in that system, the ecosystem would suffer and change?
A. invasive species B. ecological species C. distributive species D. keystone species

29. The leaflike structures that make up part of the plant embryo and transfer nutrients to the embryo are called what?

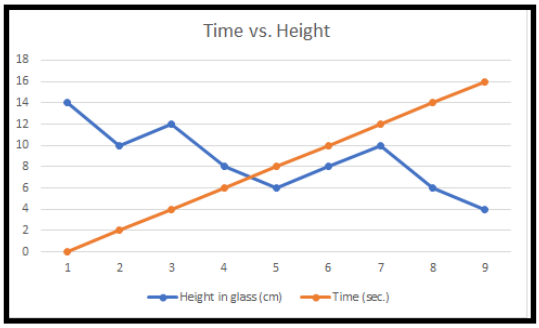
A. cotyledons B. seed coats C. pollen D. gametophytes

30. What do all these terms (sepals, petals, stamens, anther, pistil, ovary) have in common?

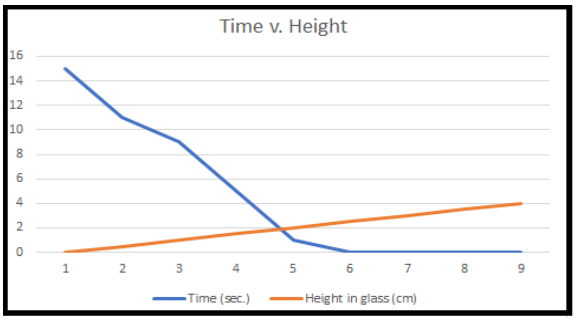
A. They are parts of the digestive system.
B. They are parts of flowers.
C. They carry out photosynthesis for the plant.
D. They are all pollinators.

31. Which graph below would best represent the height of soft drink in a glass as a person sips it through a straw?

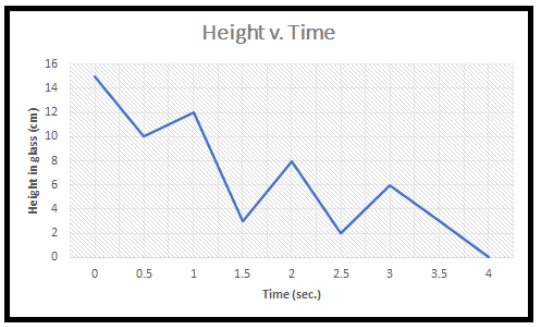
A.



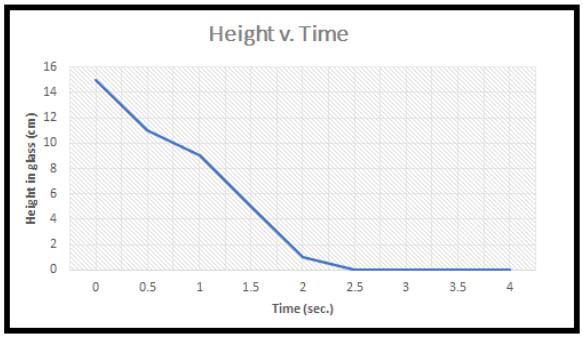
B.



C.



D.



32. The potential energy is measured with what unit?

A. Joules B. meters C. Newtons D. Ohms

33. Three main types of potential energy are elastic, chemical, and what?

A. momentum B. kinetic C. static D. gravitational

34. When the atoms, molecules, or ions of a substance are rearranged during a process, then what happens?

A. chemical reaction B. physical change C. particle acceleration D. nothing is changed

35. What type of rock is formed by heat and pressure?
A. sedimentary B. igneous C. metamorphic D. minerals

36. What is the rarest occurring pigment found in nature on Earth?
A. red B. blue C. purple D. green

37. What term is used in geology for the breaking down of rocks into sediments?
A. weathering B. extinction C. mass wasting D. erosion

38. Which of these conduits is designed to compress a fluid passing through it to a state of high pressure?
A. gutter B. nozzle C. PVC pipe D. channel

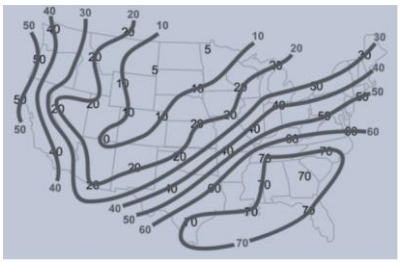
39. What is a semiconductor used for and what is it made of?
A. electrical wiring, and copper
B. insulation, and gold
C. plumbing pipes, and plastic
D. computer components, and silicon

40. Planet Facts: 1) eleven times wider than Earth 2) over 50 moons 3) has great red spot
Name that planet!
A. Mercury B. Jupiter C. Saturn D. Uranus

41. Which statement below about physical terms is incorrect?
A. Tendency of an object to resist change in its motion is called inertia.
B. Potential energy is the energy an object has because of its density.
C. Momentum is the product of mass and velocity.
D. Kinetic energy is the energy an object has because of its motion.

42. What devices on an automobile affect acceleration?
A. steering wheel B. brake pedal C. gas pedal D. all of these

43. In the map to the right, the lines connecting these dewpoint temperatures are called what?
A. isobars
B. barotherms
C. hydrotherms
D. isodrosotherms



44. An extra device added for protection that helps to eliminate overload on an electric circuit is called what?
A. fuse B. switch C. battery D. coupling

45. Monarch butterflies contain a chemical called a cardenolide. They obtain this chemical by doing what?

A. drinking nectar from poisonous flowers
B. no one knows how they get this chemical
C. ingesting milkweed as a caterpillar
D. brushing up against plants that have been sprayed with insecticides

46. What is the difference between a monocot and a dicot?
A. Monocots have only 1 main root and dicots have 2.
B. Dicots are herbaceous and monocots are not.
C. Monocots branch out from the main stem and dicots do not.
D. Monocots have 1 cotyledon and dicots have 2.

47. What part of the flower protects the flower from damage when it is in the bud stage?
A. pistils B. petals C. stamens D. sepals

48. Jerry saw the moon, bright and full, on the evening of his birthday. In about 4 days, he looked again for the moon. When he found it in the night sky, it was in what phase now?
A. new moon
B. waning crescent
C. waning gibbous
D. waxing gibbous

49. What type of rock would possibly be composed of bits and pieces of ancient marine life?
A. metamorphic
B. igneous
C. sedimentary
D. no rock contains marine life

50. A commonly used method to measure the age of organic material is what?
A. uranium based dating
B. historical comparison
C. artificial dating
D. radiocarbon dating

2022 - 2023 TMSCA Middle School Science #2 Test - Key

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