

# TMSCA MIDDLE SCHOOL SCIENCE TEST #5 © NOVEMBER 16, 2019

## 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<sup>x</sup>, ln x, y<sup>x</sup>, sin x, sin<sup>-x</sup>, cos x, cos<sup>-x</sup>, tan x, tan<sup>-x</sup>, 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  $\pm 5\%$  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.

1A 1																	2A 2											3A 13	4A 14	5A 15	6A 16	7A 17	8A 18
1 H 1.01																	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 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,  $g = 9.81 \text{ m/s}^2$**

**Avogadro's Number,  $N = 6.02 \times 10^{23}$  molecules/mole**

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

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

**Standard temperature and pressure (STP) is 0°C and 1 atmosphere**

**Gram molecular volume at STP = 22.4 liters**

**Velocity of light,  $c = 3.0 \times 10^8 \text{ m/sec}$**

**Absolute zero= 0 K = -273.15°C**

**Gas constant,  $R = 1.986 \text{ cal/K}\cdot\text{mole} = 0.082 \text{ liter}\cdot\text{atm/K}\cdot\text{mole}$**

**One Faraday= 96,500 coulombs ( $9.65 \times 10^4$  C)**

**Dulong and Pelil's constant=  $6.0 \text{ amu} \cdot \text{cal}/\text{gram} \cdot \text{K}$**

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

**Atomic mass unit,  $m_u = 1.66 \times 10^{-27}$  kg**

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

Permittivity of free space  $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{N}\cdot\text{m}^2$

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

**1 Atmosphere =  $1.02 \times 10^5 \text{ N/m}^2$  = 760 Torr = 760 mmHg**

**1 Electron Volt -  $1.6 \times 10^{-19}$  Joules**

**Charge of on electron'''  $-1.6 \times 10^{-19}$  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 heat of water =  $4.18 \text{ J/g} \cdot ^\circ\text{C}$**

## 2019-2020 TMSCA Middle School Science Test #5

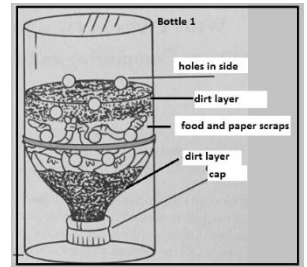
1. In the past, people would throw their food scraps and yard wastes in vacant fields to let them decompose. Now, there are fewer vacant fields and this practice is longer allowed. Which of the following is a more environmentally friendly and acceptable way of disposing of these items?

- A. hide them in a nearby ditch on an old road
- B. place them in a compost pile
- C. place them in the trash which then goes to a landfill
- D. burn them in a brush pile

2. Students in Mr. Miller's class were testing out different methods of compost piles. They used three upside down bottles that were cut open. In Bottle 1, they placed a layer of dirt, layer of food and paper scraps, and another layer of dirt. In Bottle 2, they placed a layer of dirt, layer of food and paper scraps, tablespoon of yeast and water mixture, and another layer of dirt. In Bottle 3, they placed a layer of dirt, layer of food and paper scraps, four or five redworms, and another layer of dirt. All three bottles were placed in a box with the same sunlight exposure and the dirt used in each container was from the same source.

What could be a reasonable hypothesis for this experiment?

- A. The extra dirt layer will increase decomposition of the scraps.
- B. The yeast and water mixture will increase decomposition of the scraps.
- C. The food and paper scraps will decompose best if placed in a dark area.
- D. The worms will escape which will decrease decomposition.



3. What would be the independent variable in the experiment above?

- A. the amount of sunlight that each pile receives
- B. the type of dirt used in the experiment
- C. the arrangement of the dirt in the layers
- D. the method of decomposition, items added to compost pile

4. What would be the dependent variable in the experiment above?

- A. the number of worms that are used
- B. the number of bottles that are used in the experiment
- C. the type of food in the scraps
- D. the amount of decomposition that takes place

5. What would be considered the control in the experiment above?

- A. the source of the dirt
- B. Bottle 1
- C. Both B and D
- D. Bottle 3

6. Which of the following statements about jellyfish is not true?

- A. Jellyfish have no brain.
- B. Jellyfish have a two chambered heart.
- C. Jellyfish have stinging cells on their tentacles.
- D. Jellyfish have no eyes.

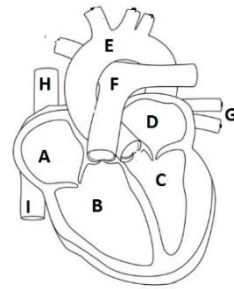
7. The arm contains muscles that will bend and straighten the arm.

Which muscle is responsible for what?

- A. the extensor bends, the flexor straightens
- B. the ligaments bend, the tendons straighten
- C. The tendons bend, the ligaments straighten
- D. the flexor bends, the extensor straightens

8. Which chamber of this heart diagram has the function of pumping the de-oxygenated blood to the lungs?

- A. Part A
- B. Part B
- C. Part C
- D. Part D

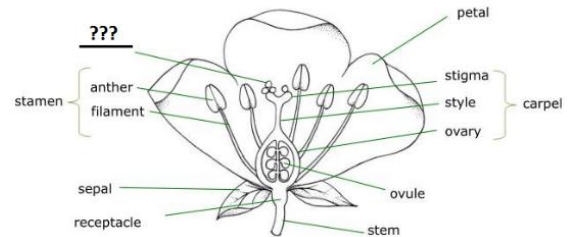


9. Which of the following is best in describing the prefix “arthr-“?

- A. old
- B. human
- C. joint
- D. round

10. In this diagram of a flower, the part labeled “???” represents what? (male gamete)

- A. pistil
- B. dust
- C. calyx
- D. pollen



11. Clues: phase of mitosis, centromeres divide, chromatids (now called chromosomes) move toward opposite poles of cell      What phase is this?

- A. Prophase
- B. Metaphase
- C. Anaphase
- D. Telophase

12. What term below relates the energy in one quantum of electromagnetic radiation with the frequency of the radiation?

- A. Planck’s constant
- B. Boltzmann’s constant
- C. Avogadro’s number
- D. Faraday

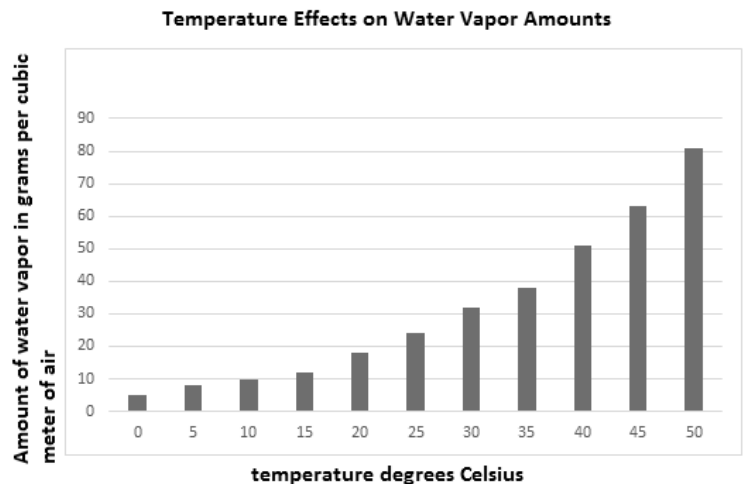
13. The specific heat of water is considered to be what?

- A. lower than most other common substances
- B. higher than most other common substances
- C. 4.184 Joules/gram · °C
- D. both B and C

14. An atom or molecule that has an electric charge due to the loss or gain of one or more electrons is called what?
- A. isotope                      B. transient                      C. t-particle                      D. ion
15. The pH of a glass of milk is 6.5 and the pH of a glass of orange juice is 3.5. Which is true about these drinks?
- A. The milk is 1,000 times more acidic than orange juice.  
B. The orange juice is 1,000 times more acidic than milk.  
C. The orange juice is 3 times more acidic than orange juice.  
D. The milk is 3 times more basic than orange juice.
16. When electrons are transferred from one atom to another what type of bond is formed?
- A. covalent                      B. metallic                      C. ionic                      D. sessile
17. The H-R Diagram is used to do what?
- A. classify planets and asteroids  
B. arrange comets in orbit around sun  
C. classify stars by several characteristics  
D. arrange black holes in evolutionary stage
18. Sand can be formed by which of the following?
- A. parrotfish poop  
B. broken down rocks that have been weathered and eroded  
C. Both A and B  
D. Neither A or B
19. Which of the following lists best describes what makes up a comet?
- A. iron, bits and pieces of broken asteroids  
B. sand, planetary nebulae, sulfur  
C. dusts, rocky meteoritic materials, ice  
D. solar wind, neutrinos, rocks
20. If an optometrist wants to correct a person's vision who has myopia, what type of lens would work best?
- A. converging                      B. bifocal                      C. concave                      D. convex
21. How are velocity and speed different?
- A. velocity is just speed, but with a formula  
B. speed includes acceleration  
C. velocity is much faster  
D. velocity includes direction

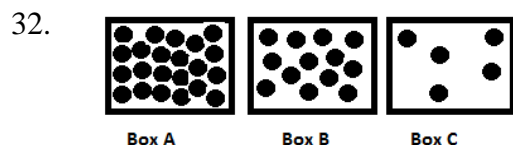
22. The outside parts of the ladder that make up DNA molecule are composed of alternating what?
- adenine and cytosine
  - deoxyribose and nitrogen
  - guanine and thymine
  - sugar and phosphate
23. What determines which protein a cell will make?
- the sequence of the bases in the DNA
  - water and its availability
  - osmosis
  - the amount of phosphates in the molecule
24. Which of the following landforms can be found on the planet Mars?
- volcanoes
  - sand dunes
  - craters
  - all of these
25. The Astronomical Unit (AU) is based on what?
- the distance light can travel in one year
  - the average distance between Earth and the sun
  - the average distance between all the planets in our solar system
  - the distance between the sun and Alpha Centauri

26. This graph shows the temperature and amount of water vapor in the air accordingly. If the air temperature is 50 deg. C, about how much water vapor would there be in ten cubic meters of air?
- 80g
  - 40 g
  - 30 g
  - 800 g



27. The protein \_\_\_\_\_ that makes up hair, skin, and nails is a big part of the \_\_\_\_\_ (body system).
- myosin, muscular
  - keratin, integumentary
  - enzymes, digestive
  - hemoglobin, circulatory
28. Which of the following belongs in kingdom animalia?
- algae
  - fungus
  - coral
  - zooplankton

29. Decomposers benefit an ecosystem by doing mostly what?
- Filtering out pollutants
  - Replenishing moisture to the atmosphere
  - Preventing organisms from becoming too populated
  - Returning nutrients to the soil
30. How did the Achilles tendon get its name?
- named by the early Romans to describe a heroic act when Achilles jumped into the Coliseum to save his friend
  - named after the Greek mythological figure who was dipped into the Styx river except for his heel and died when Paris's arrow struck that unprotected location on his foot
  - named for the Latin word that means "connection"
  - named after the scientist who developed a cure for foot fungus
31. What is the source of "body odor" in humans?
- sweat
  - pheromones
  - apocrine glands and bacteria
  - hormones

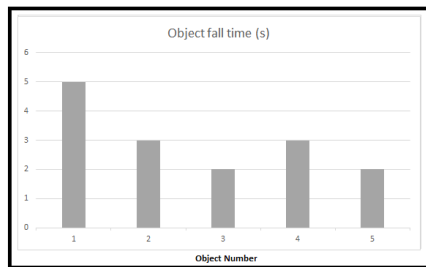


Which description below would best match the above diagram on the arrangement of atoms in states of matter?

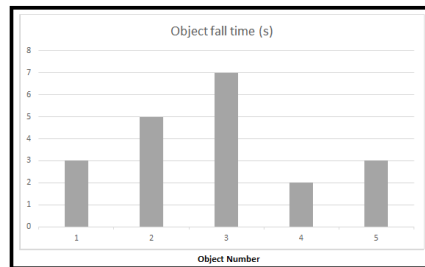
- Box A – gas      Box B – liquid      Box C – solid
  - Box A – solid      Box B – liquid      Box C – gas
  - Box A – liquid      Box B – solid      Box C – gas
  - Box A – solid      Box B – gas      Box C – liquid
33. Using this chart, what would go in the two blank spots?
- | Power     | Voltage    | Current  |
|-----------|------------|----------|
| 60 watts  | 120 volts  | 0.5 amps |
| 200 watts | ?          | 2 amps   |
| 194 watts | 38.8 volts | ?        |
- 400 volts, 5 amps
  - 100 volts, 3 amps
  - 400 volts, 2 amps
  - 100 volts, 5 amps
34. Around the Northern Atlantic and Northeast Pacific Ocean, what we call a "hurricane" would be called what instead?
- typhoon
  - depression
  - cyclone
  - also, a hurricane
35. Stars in the stable phase of hydrogen burning are placed in what part of the H-R Diagram?
- Main Sequence Stars
  - White dwarf corner
  - top right corner
  - Red Giant Branch

36. While filming an adventure movie, the lead actor had a scene in which he was standing on top of a train that was moving at a constant speed. During the scene, he had to jump straight up in the air to avoid a villain. According to Newton's first law of motion, when the actor came down, where did he land?
- slightly behind the spot that he jumped from on the train roof
  - slightly in front of the spot that he jumped from on the train roof
  - in the same spot that he jumped up from
  - about 10 feet behind the spot he jumped from depending on the train's speed
37. Mrs. Chase's science class was investigating the time it takes for 5 objects to fall off the roof. The 5 objects were all the same shape, but not the same mass. Which graph below would most likely show the data that they collected during the investigation?

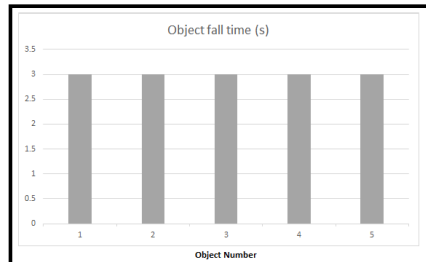
A.



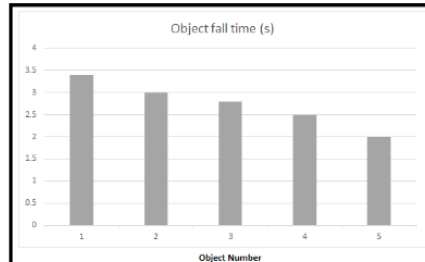
C.



B.



D.



38. Which match below correctly shows a bone and tendon relationship?
- patellar tendon and humerus
  - temporalis tendon and toe bone
  - rectus abdominus and ulna
  - Achilles tendon and calcaneus
39. What are the two largest bones in your foot that carry the majority of your weight?
- femur and tibia
  - calcaneus and talus
  - metacarpal and cuboid
  - phalange and cuneiform



40. Clues: most are between Mars and Jupiter, small planet-like odd shaped bodies in space, size ranges from a few hundred km to less than 1 km across      What are these?  
A. starlets      B. asteroids      C. comets      D. metallic meteoroids
41. Which of the following is a bowl-shaped depression carved out by a glacier?  
A. fjords      B. horns      C. arêtes      D. cirques
42. The Matterhorn in the Swiss Alps is an example of a what that was formed by a glacier?  
A. cirques      B. fjords      C. horns      D. roche moutonnée
43. Instinctive seasonal movement of animals to find food or to reproduce is called what?  
A. hibernation      B. migration      C. mitigation      D. brumation
44. Which type of rock formed quickly on the Earth's surface?  
A. intrusive igneous      B. extrusive igneous      C. sedimentary      D. metamorphic
45. What is the source of energy for chemosynthesis?  
A. sunlight      B. ocean floor      C. tubeworms      D. chemicals from hydrothermal vents
46. Stalagmites and stalactites that form in caves are composed mainly of what?  
A. calcium carbonate      B. mineral gypsum      C. Both A and B      D. talc
47. Which term below has to do with the heat capacities of elements?  
A. Planck's constant  
B. Boltzmann's constant  
C. Avogadro's number  
D. Dulong and Petit's constant
48. Lye soap would be about 13 on the pH scale. This makes it a what?  
A. strong acid      B. weak acid      C. strong base      D. weak base
49. Which of these causes sound to travel at a slower speed through air?  
A. cooler temperature of the air it travels through  
B. warmer temperature of the air it travels through  
C. low atmospheric air pressure  
D. higher magnitude of the sound
50. Hurricane Harvey, before making landfall, was rated a 4 on the Saffir-Simpson Hurricane Wind Scale. This rating was based on what?  
A. the hurricane's sustained wind speed  
B. the top wind speed  
C. on the damage the storm will cause  
D. on the low-pressure readings

**2019 - 2020 TMSCA Middle School Science Test #5 - Key**

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