

**TMSCA MIDDLE SCHOOL
SCIENCE
TEST #3 ©
NOVEMBER 5, 2022**

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, ln x, 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 $\pm 5\%$ 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.

Periodic Table of the Elements

1A 1																	2A 2											3A 13	4A 14	5A 15	6A 16	7A 17	8A 18		
1 H 1.01																	2 He 4.00											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18		
3 Li 6.94	4 Be 9.01																	11 Na 22.99	12 Mg 24.31	3B 3	4B 4	5B 5	6B 6	7B 7	8B 8	9B 9	10B 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 = $0 \text{ K} = -273.15^\circ\text{C}$

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 ($9.65 \times 10^4 \text{ C}$)

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

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

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

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

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

Charge of an electron = $-1.6 \times 10^{-19} \text{ coulombs (C)}$

1 horsepower (hp) = $746 \text{ W} = 550 \text{ ft}\cdot\text{lb/s}$

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 = $4.18 \text{ J/g}\cdot^\circ\text{C}$

2022-2023 TMSCA Middle School Science Test - #3

Coy’s class was investigating what materials would decompose more easily. His class prepared 5 plastic bags with regular soil. In each bag, they placed equal amounts of different substances shown in the chart. They moistened the soil in the bag, sealed them, and then left the bags at room temperature. Each day, they gave each of the bags a vigorous shaking. After each week for 5 weeks, they counted the intact pieces of each item and recorded the percentage of the item that was left of the substance.

Substances	Week 1	Week 2	Week 3	Week 4	Week 5
Leafy vegetables	80%	75%	60%	40%	25%
Cotton cloth	100%	95%	80%	70%	60%
Styrofoam	100%	100%	100%	100%	100%
Aluminum foil	100%	100%	100%	100%	100%
Paper	90%	80%	50%	30%	10%

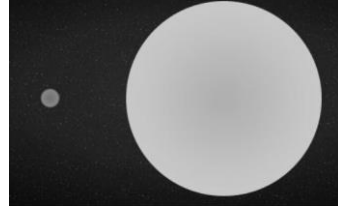
1. According to the above results, which substance decomposed more completely after 5 weeks?
A. paper B. leafy vegetables C. cotton cloth D. Styrofoam
2. According to the above results, which substance began to decompose the fastest after 2 weeks?
A. paper B. leafy vegetables C. cotton cloth D. aluminum foil
3. What would be a factual statement that could be said from the results?
A. Styrofoam and Aluminum foil are the most likely to decompose in soil than all the others.
B. In week 3, cotton cloth had decomposed the most.
C. From Week 1 and 5, there was no change in both the paper and Styrofoam.
D. Leafy vegetables and paper are more likely to decompose in soil than aluminum foil and Styrofoam.
4. The transfer of thermal energy by actual physical movement from one location to another of a substance in which thermal energy is stored is called what?
A. heat convection B. heat conduction C. heat conversion D. heat shear
5. An engineer was working on a method to remove dissolved minerals (including salts) from seawater with greater efficiency. Which word below would be associated with this project?
A. treatment B. hardening C. conversion D. desalination
6. Which of the following devices is an essential part used in motors, generators, electromechanical devices, and in some medical equipment?
A. concrete B. volt C. magnet D. antenna
7. What is it called when species must use the same limited resources to survive?
A. commensalism B. innate behaviors C. niche D. competition
8. Which Ecoregion of Texas would include the cities of Amarillo and Dumas?
A. Edward’s Plateau B. Trans-Pecos C. High Plains D. Cross Timber

9. Which one of the following is not a correct unit of volume?

- A. mg B. mL C. cm³ D. m³

10. If the circle on the left represents Earth, then what does the circle on the right represent with the size comparison?

- A. Venus
B. Mercury
C. Jupiter
D. Sun



11. A copper wire's electrical resistance depends on which of the following?

- A. temperature of the wire
B. thickness of the wire
C. length of the wire
D. all of these

12. Benito has a mineral called Galena that can scratch gypsum but not calcite.

What would its relative hardness be?

- A. between 1 and 2
B. between 2 and 3
C. exactly 3
D. between 3 and 4

Mineral	Mohs relative Hardness
Talc	1
Gypsum	2
Calcite	3
Fluorite	4
Apatite	5
Orthoclase	6
Quartz	7
Topaz	8
Corundum	9
Diamond	10

13. Which of the following is a metalloid?

- A. Carbon B. Helium C. Boron D. Both A and B

14. Which of the following is a nonmetal?

- A. Nitrogen B. Phosphorus C. Chlorine D. All of these

15. A black cat standing on a table decided to push a pencil with a force of .75 N to the edge of the table. The pencil moved 10cm. What amount of work did the cat do on the pencil?

- A. 0.075 J B. 7.5 J C. 13.3 J D. 0.75 J

16. After the black cat pushed the pencil to the edge of the table, the force of gravity caused the pencil to fall to the floor which was .75 m from the table. Was any work done on the pencil?

- A. No work was done on the pencil.
B. Yes, work was done also by gravity.
C. Work was only done by the cat.
D. There is no way to tell if work was done.

17. A “lentic” system includes which of the following?

- A. ponds, lakes, marshes
- B. canyons, buttes, mesas
- C. rivers, creeks, and streams
- D. plains, mountains, hills

18. Researchers at the zoo conducted a study of what insects one of their lizards preferred to eat. To do this, they needed to dissect the feces or scat of the lizard and then identify the insect parts found in the scat. What term is used for this type of research?

- A. in vivo
- B. in grosso
- C. in vitro
- D. in fimo

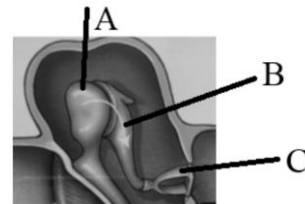
19. According to the Red Cross, what is the rarest blood type?

- A. O-
- B. O+
- C. A+
- D. AB-



20. The diagram is showing three important bones in the ear. Which list correctly identifies the bones?

- A. A- malleus B- incus C-stapes
- B. A- stapes B - incus C- malleus
- C. A- malleus B – stapes C - incus
- D. A - incus B – malleus C – stapes



21. Where does the process of chemical digestion first take place in humans?

- A. the esophagus
- B. small intestines
- C. acid in the stomach
- D. saliva in the mouth

22. A girl saw her baby sister walking dangerously close to the edge of a swimming pool. She quickly ran and picked up her sister. During this event, the girl’s hypothalamus in her brain set off an alarm which in turn caused her adrenal gland to release a surge of hormones into her bloodstream. What two hormones would be included in this release from this stressful event?

- A. adrenaline and cortisol
- B. insulin and glycerin
- C. oxytocin and insulin
- D. cortisol and melatonin

23. Which of the following is a rare earth metal?

- A. Ce
- B. Sc
- C. Tb
- D. All of these

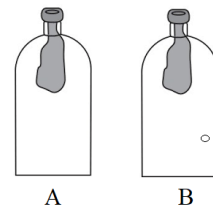
24. Which of the following is a use of a magnet?

- A. keeping a refrigerator door closed
- B. MRI medical equipment
- C. audio speakers
- D. all of these

25. Viscosity of a liquid can vary depending on what condition?
- change in color
 - type of container that holds the liquid
 - change in temperature
 - volume
26. Avogadro's Number is equal to what?
- 6.02×10^{23} particles
 - The number of particles in 12 grams of any element.
 - 1 mole
 - Both A and C
27. Which of the statements below about pH is true?
- pH measures the amount of salt in a solution.
 - The conductivity of a substance is the pH.
 - The scale of pH ranges from 0 to 14, with 0 being the weakest acid and 14 the strongest acid.
 - The relative measure of hydrogen ion concentration within a solution is the pH.
28. If a flower has all these parts – sepals, petals, stamens, pistils then it is called a what?
- archegonium
 - sporophyte
 - incomplete
 - complete
29. Which statement below describes a way that animals differ from plants?
- animals have no cell walls
 - plants are prokaryotic
 - animals have chlorophyll
 - plants reproduce only asexually
30. Which of the following does not help with identification of a tornado?
- rapidly rotating column of air
 - extending from the cloud to the ground
 - sometimes has debris with it
 - always spinning a clockwise direction

31. Look at these two bottles.

If you try to blow up the balloon in each of these bottles, which statement below would be true?



- You will be able to blow up the balloon only in bottle A because bottle B has a hole in it to release the air already in the bottle.
- You will be able to blow up the balloon in both bottles because the hole makes no difference.
- You will be able to blow up the balloon only in bottle B because bottle B has a hole in it to release the air already in the bottle.
- It is impossible to blow up a balloon in both bottles because of air pressure.

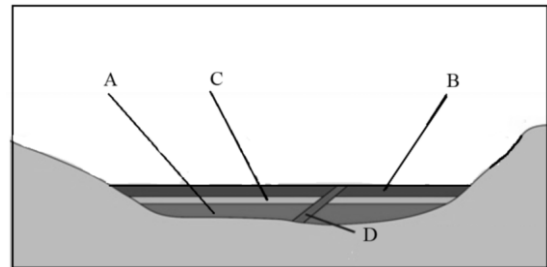
32. This bird is known as a common nighthawk. Its wings are perfect for doing what?
- A. flying at a slow even pace
 - B. soaring without flapping its wings
 - C. hovering over a plant to drink nectar
 - D. making sudden and agile maneuvers in flight



33. Where would you most likely find amphibians in a water body?
- A. littoral zone
 - B. limnetic zone
 - C. profundal zone
 - D. Both B and C

34. In this diagram, which labeled layer happened first in Geologic time?

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



35. In a vascular plant, the tissue that carries food to other parts of the plant is called what?
- A. stomata
 - B. xylem
 - C. cambium
 - D. phloem
36. When comparing a cell to a house, what cell part would perform the same role as a closet for storage in the house?
- A. nucleus
 - B. cytoplasm
 - C. vacuoles
 - D. mitochondria
37. What is another name for the tibia?
- A. fibula
 - B. shin bone
 - C. navicular
 - D. hyoid
38. Dale kicked a soccer ball 100 m. He used a force of 15 N. How much work was done on the ball by Dale?
- A. 0.15 J
 - B. 6.67 J
 - C. 150 J
 - D. 1500 J
39. The terms “invasive, native, introduced” depend on what to distinguish between them?
- A. the number of the species
 - B. the abundance of the species
 - C. the diversity of the species
 - D. the original location of the species
40. A wildfire burned 5,000 acres of a North Texas prairie. In the next few months, grasses began to grow back, then shrubs, and trees. What type of succession would this represent?
- A. secondary succession
 - B. primary succession
 - C. volcanic succession
 - D. ecological progression

41. Which of the following scientist's work was the foundation of rocket propulsion?
A. Hans Christian Oersted
B. Alexander Fleming
C. Robert Goddard
D. Elon Musk
42. Students in Mr. Sherwood's class were studying about the rock cycle. They took a piece of chalk and put it in a bottle. Next, they shook the bottle 100 times. (as they did, pieces of the chalk broke off into smaller sediments) What were they most likely modeling with this activity?
A. how difficult it is to break down chalk
B. erosion
C. chemical weathering
D. physical weathering
43. A self-sustaining population of a non-native species in an ecosystem is called what?
A. core species B. biological control C. invasive species D. naturalized species
44. Illegal hunting or capturing of wild animals is called what?
A. sustaining B. poaching C. harvesting D. seeking
45. When heat is trapped in the Earth's lower atmosphere by gases such as carbon dioxide, methane, water vapor, and nitrous oxides, this is known as what?
A. deforestation B. climate change C. greenhouse effect D. sustainability
46. An instrument that is used to measure atmospheric pressure is called a what?
A. seismic scale B. seismograph C. epicenter D. barometer
47. Oxygen is found in a molecule made of only two atoms bonded together. This is known as a what?
A. carboxyl molecule B. cryogenic molecule C. bipolar molecule D. diatomic molecule
48. What three elements make the CaCO_3 compound?
A. Calcium and Oxygen only
B. Calcium, Carbon, Cobalt
C. Carbon and Cobalt only
D. Calcium, Carbon, Oxygen
49. Organic matter that comes from plants, such as wood, stems, dried leaves, or from animals, such as dung are all known as what?
A. abiotic factors B. sediments C. ecological succession D. biomass
50. One Joule per second is the same as what?
A. input B. a watt C. an ohm D. pressure

2022 - 2023 TMSCA Middle School Science #3 Test - Key

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