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

S C I E N C E

G E A R U P ©

D E C E M B E R 5, 2 0 2 1

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

2021-2022 TMSCA Middle School Science Test – Gear Up

1. What type of energy is collected at the site in this photo?
A. solar B. geothermal C. hydro D. nuclear

2. Students at a university wanted to make a water filter that would be convenient and inexpensive to use when a person needs clean water quickly. They decided to test using the sapwood of trees as a filter. In their investigation, they developed a filter out of a white pine tree's sapwood. The students found that the filter was effective to a certain size of nanometer particles. What is considered a vital factor when testing the effectiveness of filters?
A. the time it took to make the filter
B. the cost of the filter
C. number of filters that can be made with one tree
D. the nanometer size that the filter can separate out

3. In this investigation, what would be the dependent variable?
A. the cost of the filter
B. the type of tree used to make the filter
C. the size of the particles that are filtered out
D. the time it took to make the filter

4. Sapwood is the part of the tree that does what?
A. transports food to the roots of the tree
B. transports water and minerals to crown of the tree
C. provides stability for the tree
D. carries out photosynthesis

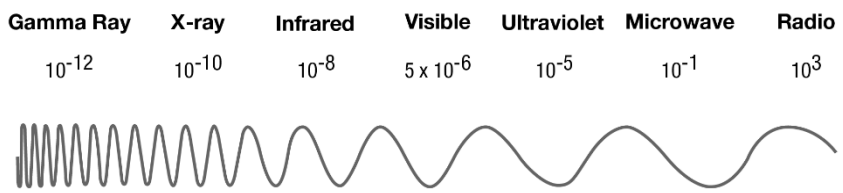
5. Which scientist below made contributions to the science of geology?
A. James Hutton B. Albert Einstein C. Gregor Mendel D. Mario Molina

6. Electrical resistance is the topic of which scientific law?
A. Halley's B. Newton's C. Ohm's D. Zeroth's

7. Complete this analogy: Charles Darwin is to Natural Selection as Alfred Wegener is to what?
A. Periodic Table of the Elements
B. The Theory of Evolution
C. Continental Drift
D. The Law of Conservation of Energy

8. An instrument used to measure blood pressure is called what?
A. barometer B. electrocardiograph C. sphygmomanometer D. ultrasound

9. A molecule having one or more unpaired outer electrons is called what?
A. free radical B. isotope C. ion D. proton



10. What is incorrect in this electromagnetic spectrum?
A. The exponents are off by 3
B. Infrared and Ultraviolet labels are switched
C. Gamma Ray and X-ray labels are switched
D. Microwave should be on far-right end.

11. What is the difference between chemosynthesis and photosynthesis?
A. they mean the same thing
B. photosynthesis involves bacteria chemosynthesis does not
C. only the amount of energy needed is different
D. the source of energy is different

12. Jenny was not getting enough oxygen in her blood. The doctor used this instrument to check her blood oxygen level. What instrument?
A. ultrasound B. thermometer C. sphygmomanometer D. pulse oximeter

13. The chemical symbol for Carbon is what?
A. Cb B. Ca C. C D. Cl

14. What statement below about Carbon is not true?
A. Carbon is not essential for life on Earth.
B. Coal and diamonds are made up of Carbon.
C. Carbon has a radioactive isotope.
D. Carbon has 6 protons.

15. Which of the following famous scientists was involved with early chemistry discoveries?
A. Ernest Rutherford B. Luis Alvarez C. James Hutton D. Louis Agassiz

16. A field scientist was studying the effect of temperature on the population of a species of insect. She conducted tests using 5 different temperature-controlled environments. What would be the independent variable in her investigation?
A. the temperatures chosen for the environments
B. the type of thermometer used to measure the temperature
C. the population of the insect species
D. there is no independent variable in this investigation

17. Which list below only contains detritivores?
A. zooplankton, phytoplankton, bacterioplankton
B. snakes, spiders, scorpions
C. earthworms, maggots, woodlice
D. algae, lichens, house plants

18. An example of an ecotone between a dry and wet environment would be what?
A. marsh B. grassland C. desert D. estuary

19. Which of the following objects would have the least inertia?
A. ping pong ball 2.7 g
B. basketball .625 kg
C. bowling ball 7.258 kg
D. tennis ball 57 g

20. Deep at the bottom of the lake, there is a zone where little, or no sunlight reaches. This is known as what?
A. estuary B. epilimnion C. photic zone D. aphotic zone

21. An astronomer discovered a brown dwarf star in a section of the galaxy. What describes what was found?
A. the beginning of a black hole
B. a medium size star that will burn for 10 billion years
C. the last stage of a supernova
D. an astronomical object that is the intermediate stage between a planet and a star

22. Which list below includes only chemical properties?
A. dissolves in water, is blue, reacts with hydrogen
B. dissolves in oil, reacts with water, is green
C. floats on water, is red, density of .86
D. reacts with sunlight, reacts with hydrogen, is flammable

23. When iron or steel is coated with zinc to help keep it from rusting, this is known as what?
A. corrosion B. casting C. fabrication D. galvanization

24. The number of known elements presently is approximately what?
A. between 0 to 50
B. between 50 to 100
C. between 100 to 200
D. between 200 to 300

25. Which of the following is not a characteristic of zooplankton?
A. lives in water B. single-celled animal C. multicellular animal D. primary producer

26. Which of the following organism undergoes complete metamorphosis?

A. 

B. 

C. 

D. 

27. When the acceleration of Earth's gravity is balanced by the air resistance of the atmosphere, this is known as what?
A. minimum velocity B. terminal velocity C. acceleration D. inertia

28. The symbol on a weather map that stands for a cold front is made up of a string of what?
A. triangles B. circles C. semi-circles D. rectangles

29. Texas is underlain by 600-million-year-old rocks from what time of Earth's history?
A. Cenozoic B. Mesozoic C. Precambrian D. Paleozoic

30. Protium, Deuterium, and Tritium are examples of what?
A. radioactive substances
B. elements 1, 2, and 3 on the Periodic Table of the Elements
C. isotopes of Hydrogen
D. non-related substances involving carbon

31. Native freshwater mussels help a water body by doing what?
A. increasing the turbidity of the water
B. raising the pH of the water
C. decreasing the dissolved oxygen in the water
D. filtering the water

32. Which of the following is used to describe the center of a black hole?
A. resonance B. singularity C. retrograde loop D. Roche limit

33. Earth's moon is covered with a powdery dust and rock called what?
A. silicosis
B. peat
C. silt
D. regolith

34. Sammy has a 10-pound dog. If one ounce of weight is equal to 28.3 grams, how many kilograms is Sammy's dog? (1 pound is 16 ounces)
A. 84.9 kg B. 4.528 kg C. 1,000 kg D. 4,528 kilograms

35. A reasonable explanation in science that can be tested is called what?
A. data B. law C. principle D. hypothesis

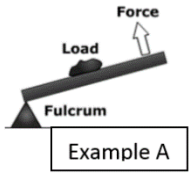
36. How many neutrons does a neutral atom of Iron have?
A. 56 B. 30 C. 26 D. 8

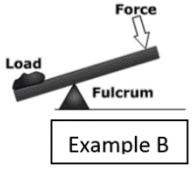
37. How much work is done if Sammy pulls a sled with 50 N of force 100 m?
A. 5000 J B. 2 J C. 500 J D. 0 J

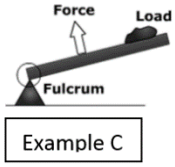
38. Larry built an electromagnet by wrapping a copper wire around an aluminum rod and connecting the wire to a 9-volt battery. His electromagnet did not work as well as he wanted it to. What could he do to improve the strength?
A. change the aluminum rod to an iron rod
B. change the wire from copper to aluminum
C. buy a more expensive 9-volt battery
D. tighten the loops of wire

39. Atoms of the same element that differ in the number of neutrons in the nucleus are what?
A. alpha particles B. ions C. isotopes D. cathodes

40. When light passes from one medium to another it is sometimes bent or changes direction. This is known as what?
A. refraction B. transparency C. reflection D. opaque







41. Which diagram above illustrates a third-class lever?
A. Example A B. Example B C. Example C D. None of these

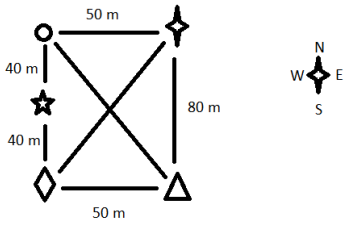
42. Which statement below is not true about the Geologic Time Scale?
A. Precambrian is the oldest and longest period on the scale.
B. Mesozoic is the age of the dinosaurs.
C. Geologic time periods are spaced out in equal time amounts.
D. The Cenozoic era started about 65 million years ago.

43. Which of the following happened first in the history of science?
A. mapping of first human genome
B. first human was launched into space
C. first telephone invented
D. Einstein published theory of relativity

44. What is found in the nucleus of a cell, is a small thread-like body that contains DNA, and transmits hereditary characteristics?

A. vacuole B. ribosomes C. nucleolus D. chromosomes

45. Using the map to the right, calculate the displacement for a person who started at the triangle, went approximately 47.15m northwest, then 47.15 m southwest, and then 80 m north.



A. 220 m B. 130 m C. 94.3 m D. 0 m

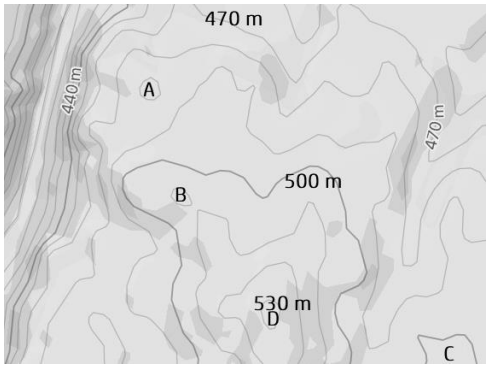
46. What is the average speed of a train that is travelling a distance of 350 miles in 5 hours?

A. 7 mph B. 70 mph C. 700 mph D. 1,750 mph

47. In this food chain, plant ⟶ aphid ⟶ ladybird beetle ⟶ bird, what role does this insect have?

A. producer
B. primary consumer
C. secondary consumer
D. tertiary consumer

48. Joseph wanted to take a photo from a high point on his property. Out of points A, B, C, or D, which place should he stand to take the photo?



A. Point A
B. Point B
C. Point C
D. Point D

49. Which word(s) below correctly labels this animal?

A. predator
B. raptor
C. hawk
D. all of these

50. The fear response in humans begins in what region of the brain?

A. amygdala B. cerebellum C. cerebrum D. hippocampus

2021 - 2022 TMSCA Middle School Science Test- Gear UP -Key

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