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 # 4 ©

N O V E M B E R 7 , 2 0 2 0

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

2020-2021 TMSCA Middle School Science Test #4

1. Below is a chart of recommended light levels for some public places. When Adara went into a local retail store, she used an app on her phone to measure the light intensity. She saw this screen:

Place	**Light intensity (lux)**
Gymnasium	300 - 500
Library	200-500
Parking Garage	50-100
Retail Sales	200-500

What statement would be true about her measurement?

A. The reading would be under the recommended level.
B. The reading would be over the recommended level.
C. The reading would be just at the right level.
D. There is no way to tell with this information.

2. Which of the following is not a true statement about millipedes?

A. they are insects
B. they have an exoskeleton
C. they are arthropods
D. they lay eggs

3. An atom contains 12 neutrons and has an atomic mass of 23. What element is this?

A. Calcium B. Magnesium C. Chlorine D. Sodium

4. Out of all the sedimentary rocks found on Earth, which type are the most abundant, making up over half of all this type of rock?

A. shale B. sandstone C. limestone D. gabbro

5. The shape of the grains in a sedimentary rock can help you find out what?

A. the composition of the rock and whether it can withstand weathering
B. what type of volcanic activity took place nearby
C. the age of the rock
D. whether it was carried a long or short distance before being deposited to form a rock

6. Weather on Earth takes place in what layer of the atmosphere?

A. stratosphere B. troposphere C. ionosphere D. mesosphere

7. When energy is transformed from one type to another, some of the energy is released as what type?

A. heat B. mechanical C. renewable D. light

8. Charlie was watching his favorite TV show when the power went out at his house. The TV went off immediately; Charlie was sad. What steps have to take place for Charlie's TV to work? (his house is in a grid that uses wind turbines to generate electricity)

Using the letters, put the following in the correct chronological order from left to right.

A -electrical current travels to house through transmission lines
B -uneven heating of Earth by sun causes wind
C -electrical current to television appliance
D -generator produces electrical current
E -electrical energy is transformed into light, sound, and heat energy in appliance
F -turbine blades rotate causing generator to turn

A. A, B, C, D, E, F
B. B, F, D, A, C, E
C. B, F, A, D, C, E
D. B, C, A, F, D, E

9. Complete this analogy. Darwin → finches Goodall → _____

A. manatees
B. giraffes
C. honey bees
D. chimpanzees

10. A fungal disease that has contributed to the death of millions of bats is known as what?
A. blastomycosis B. bat valley fever C. aspergillosis D. white-nose syndrome

11. An object with kinetic energy must be what?
A. stationary B. static C. moving D. balanced

12. Which of the following uses resources from the Earth that are considered nonrenewable?
A. nuclear B. wind C. solar D. tides

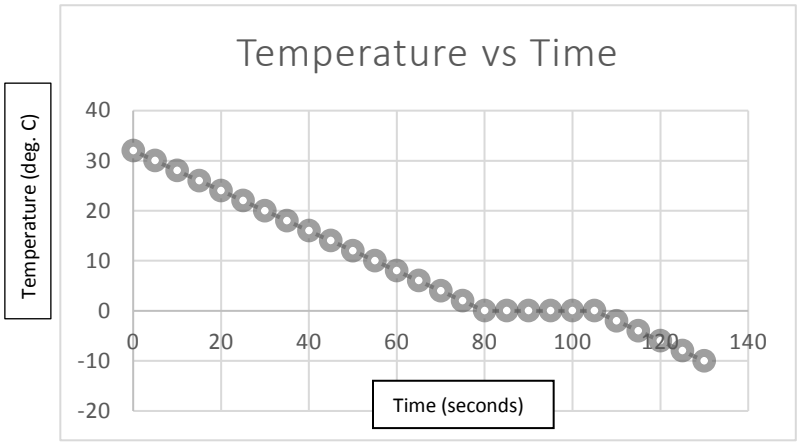
13. Machines can _____energy. Which word best completes this sentence?
A. create B. destroy C. lose D. transfer

14. Annelids are recognized by having what?
A. ganglia B. siphons C. blue blood D. segmentation

15. What plant adaptation allows the plant to delay its growth until conditions are favorable, provides protection and nourishment for the embryo, and provides a way for the plant to spread away from its parent plant?
A. flower B. cuticle C. seed D. stomata

16. What physical change of water does this graph represent?

A. freezing
B. melting
C. sublimating
D. evaporating



17. In biology, DNA is an extremely important molecule. What does DNA stand for?
A. dihydrogen nitroamino acid
B. deoxyribonucleic alkali
C. distinctive nucleic acid
D. deoxyribonucleic acid

18. What substance is known as "the universal solvent"?
A. vinegar B. water C. wax D. Epsom salt

19. When you break the rock shale, it splits into thin layers. What is this breaking pattern known as?
A. splinteration B. fissibility C. discontinuity D. severance

20. Petrified wood forms when what happens?
A. trees that have washed down a river settle to bottom of the lake to be buried over time
B. lightning strikes the trees which cause a chemical reaction to turn the tree to stone
C. when the tree dies, the wood is buried under layers of limestone and sandstone
D. volcanic ash buries trees quickly and over time, silica rich minerals replace the wood

21. What disease is believed to be caused by a person's own immune system malfunctioning?
A. tuberculous B. bacterial meningitis C. measles D. rheumatoid arthritis

22. When identifying minerals, what physical properties should be utilized?
A. shape, color, smell, weight
B. size, density, transparency, ability to crush into powder
C. Both A and B
D. hardness, luster, streak, color

23. Avogadro's Number is equal to which of these?
    A. 6.02×10^{23} particles
    B. 6.02×10^{-23} particles
    C. The number of grams in a cubic centimeter of an element
    D. The number of particles in 12 grams of any element.

24. Studying the evidence left behind, we believed that an asteroid had struck the surface of the Earth and caused the extinction of dinosaurs and other forms of life. I, a Nobel prize winning physicist, along with my geologist son, found and studied the KT boundary. Who are we?
    A. Neils and Aage Bohr
    B. Bob and Doug McKenzie
    C. Luis and Walter Alvarez
    D. William and Lawrence Bragg

25. The parallel latitude that is found 23.5 degrees north of the equator is called what?
    A. Tropic of Capricorn
    B. Antarctic Circle
    C. Arctic Circle
    D. Tropic of Cancer

26. Which of these types of organisms are "energy efficient" and do not need to consume as much food to keep their bodies warm as the other type?
    A. biotherm B. ectotherms C. isotherms D. endotherm

27. Anita was having trouble opening a glass pickle jar with a metal lid. Her mom told her to hold it under a stream of warm water in the sink. She did and then she could open it. Why did this work for Anita?
    A. air pressure differences inside and outside the jar reverse with warm water
    B. the warm water caused the glass jar to contract causing the lid to loosen
    C. the warm water caused particles in the metal to expand so there is less frictional force
    D. mom knows best all the time

28. Water bodies such as lakes and oceans, can help to regulate temperature changes near cities. This is mainly due to what?
    A. the water near the city takes longer to cool down than the land
    B. the water near the city takes longer to heat up than the land
    C. both A and B
    D. the land the city rests on takes longer to cool down than the water surrounding it

29. Which of the following rock types has a conchoidal fracture property?
    A. shale B. mica C. gypsum D. obsidian

30. I lived in Canada during the late 19th and early 20th century. I helped to isolate the hormone, insulin, which is used to treat people with diabetes. Who am I?

A. Pasteur B. Banting C. Salk D. Roentgen

31. This "slime mold" spends most of its life as a unicellular organism (protist), but when it is starving, will come together with others of its kind to produce spores which are dispersed to other places in order to find food. This behavior in organisms is called what?

A. aggregation
B. differentiation
C. colonization
D. segregation

32. Group 7A on the Periodic Table is made up of elements called what?

A. noble gases B. alkali Metals C. halogens D. alkali Earth metals

33. Viruses that attack bacteria are called what?

A. capsids B. bacteriophages C. helical virus D. novel

34. What is a negative effect of protists on humans?

A. they can disrupt a food chain by being present in the chain
B. they can slow down the recycling of vital resources in a food chain
C. diatomaceous earth (from diatoms) can be used to repel unwanted pests
D. they can cause diseases in humans and their food sources

35. If you put containers of 50 mL of tap water, 50 mL of salt water, and 50 mL of isopropyl alcohol in a freezer, which one would freeze first?

A. tap water B. salt water C. isopropyl alcohol D. all would freeze at the same time

36. What elements are included in the Lanthanides on the Periodic Table?

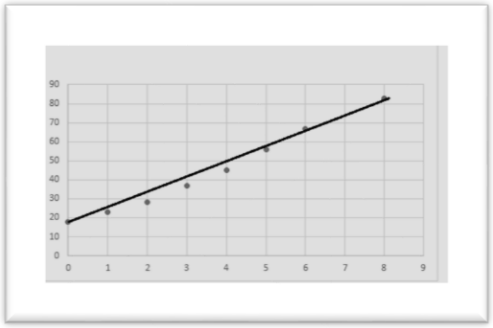
A. Mercury, Tungsten, Tin
B. Neon, Argon, Krypton
C. Sodium, Potassium, Cesium
D. Neodymium, Promethium, Cerium

37. When a television is plugged in to a wall socket and is turned on and working, what types of energy are involved?

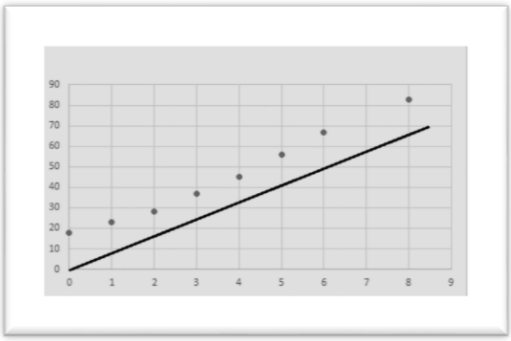
A. static energy, magnetic energy, chemical energy, and live energy
B. light energy, sound energy, heat energy, and electrical energy
C. sound energy, heat energy, electrical energy, and static energy
D. none of these are correct

38. Which of the following shows a "best fit line" for the data shown?

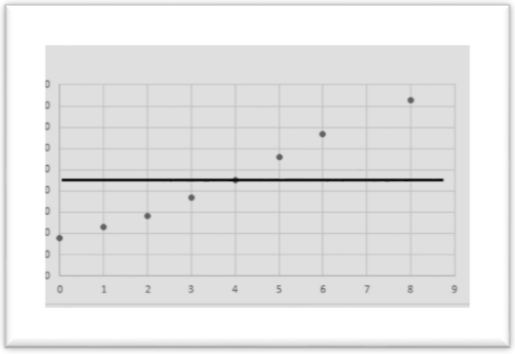
A.



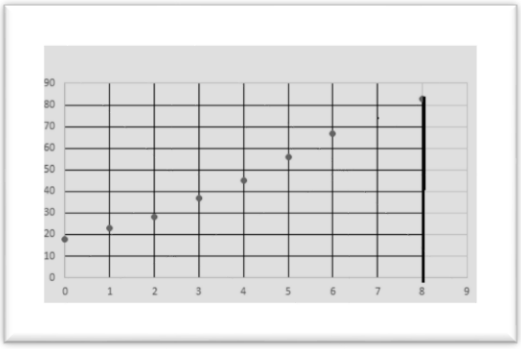
B.



C.



D.



39. What is mitosis?

A. the division of the cell into two cells with half the genetic material
B. the process in which cytoplasm is split in the cell
C. process during cell division in which the nucleus of a cell is divided into two nuclei
D. the division of a cell for the purpose of sexual reproduction

40. Which of the following is not considered to be a fossil?

A. concretion
B. petrified wood
C. coprolites
D. an impression of a leaf preserved in shale from 290 million years ago

41. This chart shows minerals and the principal ores in which they are found, and the density.

If a company mined an ore and was able to get 50 m^3 of a metal with a mass of approximately 445,000 kg from the ore, what ore were they mining? (using this chart)

Metal	**Principal Ore**	**Density**
Aluminum	Bauxite	2.7 g/cm^3
Lead	Galena	11.34 g/cm^3
Nickel	Pentlandite	8.9 g/cm^3
Zinc	Sphalerite	7.14 g/cm^3

A. Bauxite B. Galena C. Pentlandite D. Zinc

42. All matter is made of what?
    A. only solids or liquids
    B. things you can see
    C. tiny constantly vibrating particles
    D. energy

43. A good way to show how animals are related through evolution is to use a branching diagram called a what?
    A. golgi apparatus
    B. dichotomous key
    C. phylogenetic tree
    D. Both A and C

44. Which disease is caused by protists?
    A. chicken pox B. dysentery C. diabetes D. rheumatoid arthritis

45. It's night time. You see the moon in its full phase, but then the Earth's shadow slowly moves across the moon's surface and blocks the view. What are you experiencing?
    A. solar eclipse
    B. lunar eclipse
    C. gibbous moon
    D. waxing moon

46. What would be the genotype of the parents that produced the flowers shown in this Punnett square?
    A. homozygous, heterozygous
    B. homozygous, homozygous
    C. dominant, and recessive
    D. both are heterozygous

genotype: YY phenotype: yellow	genotype: Yy phenotype: yellow
genotype: Yy phenotype: yellow	genotype: yy phenotype: white

47. What percentage of the offspring shown by the Punnett square above will be homozygous?
    A. 25% B. 50% C. 75% D. 100%

48. When humans become upset or anxious, they may hyperventilate. With their breathing becoming unbalanced, they will exhale more than inhale which causes a loss of carbon dioxide in the blood making them feel several symptoms. What does the prefix "hyper" mean?
    A. down B. under C. blood D. over

49. If a person hyperventilates, the pH of that person's blood will what?
    A. stay the same B. increase C. decrease D. not register on scale

50. What is the most abundant element in the continental crust?
    A. oxygen B. silicon C. iron D. aluminum

2020 - 2021 TMSCA Middle School Science Test #4 - Key

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