TMSCA MIDDLE SCHOOL SCIENCE TEST #11 ©

FEBRUARY 10, 2018

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 1.008	2A 2																2 He 4.003
3 Li 6.941	4 Be 9.012											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 65.41	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 138.91	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 (272)	112 Cn (285)						

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
90 Th 232.04	91 Pa 231.04	92 U 238.03	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•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 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

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1. Which of the following is most important in determining the evolution of a star?

A) temperature **B)** mass **C)** radius **D)** age

2. What allows stars to shine?

A) nuclear fission **B)** nuclear fusion **C)** chemical bonds **D)** gravitational contraction

3. On the map below, where would you expect to see a rainforest?

A) A **B)** E **C)** B **D)** C

4. When you add salt to water, the boiling point _____.

A) increases
B) decreases
C) is not affected
D) will decrease only up to a certain point

5. What is the energy change when the system releases 20.0 J of heat and has 415 J of work done on it?

A) 395 J **B)** -435 J **C)** 435 J **D)** 20 J

6. The gas produced when vinegar and baking soda react together is

A) water vapor **B)** oxygen **C)** carbon dioxide **D)** carbon monoxide

7. What type of thunderstorms is most likely to produce tornadoes?

A) air mass **B)** supercell **C)** multicell **D)** dryline

8. Which of the following are causes of "wind"?

A) uneven heating of the Earth
B) rotation of the Earth
C) geographic variation of the surface of the Earth
D) all of the above

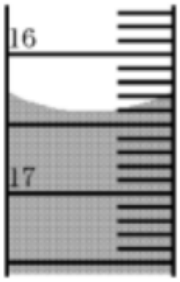
9. Most of the heart is composed of which of the following types of tissues:
A) epithelial **B)** connective **C)** nervous **D)** muscle

10. More than two-thirds of the elements are classified as
A) metals **B)** nonmetals **C)** halogens **D)** noble gases

11. Which element has the largest radius?
A) Ar **B)** Cl **C)** Fr **D)** P

12. Atoms of elements in a group on the periodic table have similar chemical properties. This similarity is most closely related to atoms'
A) number of principal energy levels
B) atomic numbers
C) the number of valence electrons
D) atomic masses

13. The following image is a measurement taken with a buret. What is the correct measurement?



A) 17.0 ml **B)** 17.60 ml **C)** 16.0 ml **D)** 16.4 ml

14. The temperature of a sample of gas is the measure of the molecules' average
A) kinetic energy **B)** potential energy **C)** ionization energy **D)** activation energy

15. Which of the following elements is alkali metals?
A) Na **B)** Mg **C)** Al **D)** Cl

16. Which gas has properties that are most similar to those of an ideal gas?
A) He **B)** H **C)** Xe **D)** O_2

17. A cube has a volume of 8.0 cm^3 and a mass of 21.6 grams. The density of the cube, in grams per cubic centimeter, is best expressed as
A) 2.7 g/cm^3 **B)** 3.7 g/cm^3 **C)** 0.37 g/cm^3 **D)** 27 g/cm^3

18. An ionic bond occurs between a
A) metal and nonmetal
B) metal and metal
C) nonmetal and nonmetal
D) metalloid and metalloid

19. Which kind of bond forms when two atoms share electrons to form a molecule?
A) ionic **B)** metallic **C)** covalent **D)** hydrogen

20. Given the structural formula below, how many electrons are shared between the two carbon atoms?

A) 2 **B)** 4 **C)** 6 **D)** 3

21. The prefix *soma-* used in science to form words such as somatic means?
A) harbor **B)** gamete **C)** body **D)** self

22. A unit by which frequency is measured would be?
A) Hertz **B)** m/s^2 **C)** amps **D)** meter

23. Which of the following scientists was awarded the Nobel Prize in 1911 for the discovery of radioactive elements such as radium and polonium?
A) Marie Curie **C)** Dimitri Mendeleev
B) John Dalton **D)** Antoine Lavoisier

24. A solution with a pH of 12 is:
A) weakly acidic **B)** strongly acidic **C)** weakly basic **D)** strongly basic

25. In the periodic table, which of the following identifies a horizontal row?
A) period **B)** group **C)** family **D)** series

26. How many oxygen atoms are found in glucose, $C_6H_{12}O_6$?
A) 12 **B)** 6 **C)** 2 **D)** 1

27. What would be the appropriate chemical name for CO?
A) carbon monoxide **C)** carbon oxygenate
B) carbon oxygen **D)** none of the above

28. The word atom is from the Greek word meaning
A) divisible **B)** indivisible **C)** small **D)** unseen

29. What is the most abundant rock found in the Earth's crust?
A) igneous rock **C)** sedimentary rock
B) metamorphic rock **D)** granite

30. A Newton is equal to which of the following?
A) kilogram-meter per second **C)** kilogram-meter per second squared
B) meter per second squared **D)** kilogram per meter-second

31. Which of the following colors of visible light has the longest wavelength?
A) violet **B)** green **C)** yellow **D)** red

32. A worker lifts a 10 kilogram block a vertical height of 2 meters. The work he does on the block is about:
A) 5 Joules **B)** 20 Joules **C)** 49 Joules **D)** 200 Joules

33. Energy is described as the capacity for:
A) reactivity **B)** combustion **C)** transformation **D)** doing work

34. The change of a gas to a liquid is called:
A) vaporization **B)** sublimation **C)** condensation **D)** freezing

35. Which one of the following particles travels at the speed of light?
A) neutrons **B)** electrons **C)** photons **D)** muons

36. Heat is transferred from the sun to the earth primarily by:
A) conduction **B)** convection **C)** radiation **D)** condensation

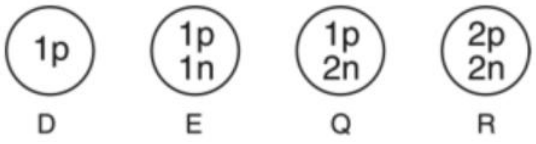
37. Organic compounds must contain what element?
A) carbon **C)** calcium
B) hydrogen **D)** oxygen

38. If it takes 2 hour to travel 30 km, your _____ speed is 15 km/h.
A) constant **B)** instantaneous **C)** average **D)** increased

39. In an experiment, the reaction rate of photosynthesis was being investigating. 10 spinach discs were treated under the same lights, but two different solutions of distilled water and sodium bicarbonate. What would be the dependent variable in this lab?
A) rate of photosynthesis **C)** the light
B) the spinach discs **D)** the different solutions

40. Mitosis creates how many daughter cells?
A) 2 **B)** 1 **C)** 4 **D)** 3

41. Each diagram below represents a nuclei of an element, which diagrams represent nuclei the same element?



A) D and E **B)** E, Q and R **C)** D and Q **D)** D, E, and Q

42. Every chlorine atom has
A) 7 electrons **C)** an atomic number of 17
B) 17 neutrons **D)** a mass number of 36

43. What term(s) best describes the situation; a car drives north 35 mph?

A) Speed
B) Acceleration and velocity
C) Velocity
D) Acceleration and speed

44. What is the acceleration of a 25 kg box that has 20 N of force applied to it?

A) 500 m/s^2 **B)** 0.8 m/s^2 **C)** 1.25 m/s^2 **D)** 5.0 m/s^2

45. If a chemical reaction begins with one reactant and ends with two or more products, what type of reaction has taken place?

A) Decomposition **B)** Synthesis **C)** Replacement **D)** None of the above

46. All of the following describe longitude except

A) Degree distance east and west
B) Western and Eastern hemispheres
C) Prime meridian
D) Equator

47. Air currents moving from the North Pole will bend _____ and air currents moving from the equator North will bend _____.

A) to the east and to the west
B) to the west and to the west
C) to the east and to the east
D) to the west and to the east

48. An anemometer measures

A) humidity **B)** air pressure **C)** wind speed **D)** weather

49. What type of cloud is known to produce possible tornadoes?

A) Cirrus **B)** Nimbostratus **C)** Stratocumulus **D)** Cumulonimbus

50. The geographic North Pole is at what latitude?

A) 90°N **B)** 30°N **C)** 90°S **D)** 30°S

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