TMSCA MIDDLE SCHOOL
SCIENCE
TEST #13 ©
FEBRUARY 23, 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^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																	8A 18
1 H 1.01	2A 2											3A 13	4A 14	5A 15	6A 16	7A 17	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, $g = 9.81$ m/s^2

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

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

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

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

Gram molecular volume al STP = 22.4 liters

Velocity of light, $c = 3.0 \times 10^8$ 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 $\times 10^4$ C)

Dulong and Pelil's constant= 6.0 amu•cal/gram•K

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

Atomic mass unit, $m_u = 1.66 \times 10^{-21}$ kg

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

Permittivity of free space $\varepsilon_0 = 8.85 \times 10^{-12}$ C^2/N•m^2

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

1 Atmosphere= 1.02×10^5 N/m^2 = 760 Torr = 760 mmHg

1 Electron Volt - 1.6×10^{-19} Joules

Charge of on electron"' -1.6×10^{-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

1. A tree has characteristics of a red maple (*Acer rubrum*) and silver maple
   (*Acer saccharinum*). It might be a what?
   A. purebred   B. mutant   C. hybrid   D. trees cannot cross species

2. An atom contains 12 neutrons and has an atomic mass of 23. What element is this?
   A. Calcium   B. Vanadium   C. Chlorine   D. Sodium

3. Joseph was experimenting with mystery metals. He had a piece of
   metal in the shape of a cube that measured 10cm on each side. He felt
   that the "mystery" metal cube was zinc but wanted to confirm this.
   When he placed it on the scale, its mass proved he was correct. What
   was the mass?
   A. 7.13 cm^3 B. 7,130 g   C. 71.3 g   D. 713 g

Metal	Density g/cm^3
Aluminum	2.70
Zinc	7.13
Iron	7.87
Copper	8.96

4. Which Ecoregion of Texas would include the city of Dallas?
   A. Piney Woods   B. Edward's Plateau   C. Blackland Prairie   D. Rolling Plains

5. Which of the following statements about the Coriolis force is correct?
   A. The Coriolis force applies to movement on rotating objects.
   B. The Coriolis force is strongest at the equator.
   C. The Coriolis force is weakest at the poles.
   D. Storms in the north swirl clockwise.

6. Ohm's law involves which of these statements?
   A. current through a conductor
   B. proportionality of current and voltage
   C. both A and B
   D. neither A or B

7. One theory explains that mitochondria and chloroplasts descended from bacteria. This is the theory of
   what?
   A. cyanobacteria   B. exocytosis   C. coevolution   D. endosymbiosis

8. This symbol, developed by Charles Baldwin in 1966,
   means what?

   A. recycle   B. biohazard   C. ionizing radiation   D. high voltage

9. Fossilized tree resin that has been known to preserve some insects from the past is called what?
   A. amber   B. pitch   C. enervate   D. shank
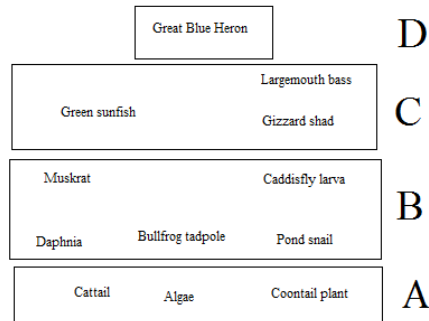
10. Which of the following would not describe a reptile?
     A. usually lay eggs   B. cold-blooded   C. dry scales   D. metamorphosis

11. If you compare a cell to a castle, then the castle wall and moat would represent what?
     A. nucleus   B. mitochondria   C. cytoplasm   D. cell membrane

12. The Lanthanides on the Periodic Table of the Elements include which of these elements?
     A. Mercury, Tungsten, Tin

     B. Neon, Argon, Krypton

     C. Sodium, Potassium, Cesium

     D. Neodymium, Promethium, Cerium

13. Which gland in the human body releases a hormone that helps to regulate calcium levels in the
     blood and also bone metabolism?
     A. pituitary   B. thyroid   C. parathyroid   D. adrenal

14. Which of the following shows a pair of inorganic compounds?
     A. NaCl   CaCO3
     B. C_2H_6 CH_4 N_2O
     C. C_3H_8 $C_2H_7O_4P$
     D. $C_6H_{12}O_6$ H_2O

15. Photosynthesis is a complicated chemical reaction in which plants make their own food. Where do
     the light-dependent reactions take place?
     A. mitochondria - inside the cell

     B. stroma – colorless fluid surrounding the grana

     C. lysosomes – organelles in the cytoplasm of the cells

     D. thylakoids – membrane-bound compartment inside the chloroplast

16. The upper jawbone is composed of two bones fused together that are called what?
     A. mandibular   B. maxillary   C. orbital   D. cranial

17. This formula below shows a possible example of what process?
     $6CO_2 + 6H_2O + 3H_2S \rightarrow C_6H_{12}O_6 + 3H_2SO_4$
     A. photosynthesis   B. oceanic symbiosis   C. chemosynthesis   D. distillation

18. Which of the following events is a chemical change?
     A. cooking an egg   B. melting ice   C. sublimation   D. evaporating alcohol
19. Organisms that make their own food are called what?
     A. heterotrophic   B. autotrophic   C. eukaryotic   D. somatic

20. An atom of hydrogen has 1 proton and 2 electrons. This means the net charge is what?
     A. 1 + (cation)
     B. 1 - (anion)
     C. Neither A or B
     D. Both A and B

21. According to the diagram on the right,
   which level would be considered
   producers?
   A. level A
   B. level B
   C. level C
   D. level D

Great Blue Heron			D
	Largemouth bass		C
Green sunfish	Gizzard shad		
Muskrat	Caddisfly larva		B
Daphnia	Bullfrog tadpole	Pond snail	
Cattail	Algae	Coontail plant	A

22. Using the same diagram, what level would be considered to be tertiary consumer(s)?
   A. level A
   B. level B
   C. level C
   D. level D

23. Complete this analogy: beaver is to wetland as alligator is to _____.
   A. river   B. swamp   C. ocean   D. bay

24. Earth has varied seasons because of why?
   A. Earth is closer to the sun in summer and further from the sun in winter
   B. Earth wobbles on its axis during the different seasons
   C. Earth is tilted on its axis
   D. Earth gets cooler as its revolution speed changes in the winter

25. During the beginning of the Paleozoic era, there was an event called the "Cambrian Explosion".
   What happened during this event?
   A. an asteroid landed in the Pacific Ocean
   B. a huge expansion in biodiversity
   C. a large number of land-walking animals developed
   D. an expansion of angiosperms

26. A science teacher wants to show her class about the process of transpiration. What would be the
   best way to do this?
   A. watch a puddle of water on a warm sunny day
   B. watch a car windshield "fog up" on a cold morning as you breathe
   C. put a leaf in a glass of water and observe it give off bubbles
   D. put a plastic bag over a leaf on a warm day to trap water droplets

27. Which of the following belong to the phylum Echinodermata?
   A. anteater, sloth, tamandua
   B. octopus, squid, cuttlefish
   C. starfish, sea cucumber, sand dollar
   D. hedgehog, armadillo, striped skunk

28. A cardinal flew onto a branch of a tree. This bird looked yellow instead of the normal red. This cardinal is an example of which of the terms below?
    A. leucism   B. melanism   C. albinism   D. xanthochromism

29. Which of these is considered the approximate velocity of light in a vacuum?
    A. 3.00×10^8 m/sec
    B. 6.63×10^{-34} J $_s$
    C. 1.66×10^{23} kg
    D. 3.00×10^{-8} km/sec

30. Kenny needed to move some of his weight room equipment in the gym. He applied 300 N of force on the weight bench to the east. His friend also pushed with 250 N of force at the same time in the same direction. The bench moved 4 meters to the east. How much work was done on the bench? (disregard any other forces acting on this bench)
    A. 2 J   B. 2,200 J   C. 550 J   D. 150 J

31. Jet aircraft usually fly in this stable layer of the Earth's atmosphere. What layer?
    A. troposphere   B. mesosphere   C. stratosphere   D. thermosphere

32. Stephen W. Hawking (physicist) said that the laws of science do not distinguish between the forward and backward directions of what?
    A. acceleration   B. momentum   C. motion   D. time

33. The word "aseptic" is an adjective that means free from what?
    A. infection   B. gravity   C. anxiety   D. harm

34. The sea anemone and the clown fish have a special type of relationship in which they help each other survive. What type of relationship is this?
    A. parasitism   B. mutualism   C. commensalism   D. symbiotism

35. A class is conducting an experiment of the effect of pH on plants. They set up six trays of grass seedlings in a sunny setting. Each tray was then watered with a different percentage solution of vinegar in water. What would be the independent variable in this experiment?
    A. the grass seedlings
    B. the amount of growth
    C. the different percentage of vinegar solutions used in watering the plants
    D. the sunlight

36. In Southwest Idaho, there is an interesting situation. During the spring and early summer, the prairie falcons live off of the Townsend ground squirrel population. As summer progresses, the ground squirrels go underground into a type of summer hibernation because of higher temperatures. When this happens, the falcons move to another area. What would be the limiting abiotic factor in this situation that would control the observation of these species?
    A. available water   B. temperature   C. amount of sunlight   D. population

37. When the ground squirrel population in Southwest Idaho go into a summer hibernation, this is called what?
    A. aestivation   B. migration   C. diapause   C. suspension

38. Which statement about Helium is not true?
    A. Helium has an atomic mass of 2
    B. Helium belongs in the noble gases group
    C. Helium is colorless, tasteless, and odorless
    D. Helium is found underground

39. What coefficients would make this chemical equation balanced?
$$C_2H_8 + \_\_\_ O_2 \rightarrow \_\_H_2O + \_\_\_CO_2$$
    A. 2, 2, 4
    B. 1, 1, 2
    C. 4, 4, 3
    D. 4, 4, 2

40. When a white flower such as a snapdragon, is crossed with a red flower of the same species, the offspring may end up being pink in color. This is an example of what?
    A. codominance
    B. incomplete dominance
    C. polygenic
    D. recessive

41. The root word "myriad" means which of the following?
    A. tall   B. many   C. maze   D. few

42. In 1961, Rachel Carson wrote a book called "Silent Spring". What is the environmental significance of this book?
    A. discussed importance of water conservation
    B. educated the public about depleting the ozone layer
    C. documented the effects of pesticides on the environment
    D. documented the effects of global warming

43. What famous scientist is known for an extensive research project studying the chimpanzees in Tanzania?
    A. Steve Irwin
    B. Jane Goodall
    C. Jeff Corwin
    D. Charles Darwin

44. Which of the following statements is true?
    A. The moon can only be seen at night.
    B. Only two planets can be seen without a telescope from Earth.
    C. The moon's phases are caused by the Earth's shadow on the moon.
    D. Earth's sun is expected to burn out in about 5 billion years.

45. Group 7A on the Periodic Table is made up of elements called what?
    A. noble gases
    B. halogens
    C. alkali metals
    D. alkali Earth metals

46. Which of the following reasons can explain why hybridization happens in some species?
    A. the two similar species territories may overlap
    B. climate change can cause a habitat shift
    C. they can't find enough mates in their own species
    D. all of these

47. A domain of life that includes single-celled organisms that usually live in harsh environments is called what?
    A. archaea   B. eukarya   C. protozoa   D. unicellular

48. Shania was working on a science project in which she plans to test the effect of high temperature on LED flashlight. She will use a LUX meter. What does this measure?
    A. light wavelength   B. light speed   C. light temperature   D. light intensity

49. An airplane flight from Dallas/Ft.Worth to Boston may take actual air time of 3.5 hrs. The return trip from Boston to Dallas/Ft Worth would be 4.25 hrs. What is a reasonable explanation why the return flight takes longer?
    A. From DFW to Boston you are flying west to east which is the opposite way the Earth is rotating which can speed up the air time.
    B. From DFW to Boston you are flying west to east which is the same way that the winds, including the jet stream, blow which makes the flight faster.
    C. The airline from Boston to DFW takes longer to process the flights because of population.
    D. The flight time is the same, it just appears to be different because of time changes.

50. Which of the following is an isotope of Iridium?
    A. Graphite
    B. Goethite
    C. Triridium
    D. none of these

    77
    Ir
    Iridium
    192.22
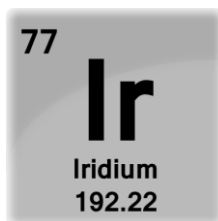
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1. C	18. A	35. C
2. D	19. B	36. B
3. B	20. B	37. A
4. C	21. A	38. A
5. A	22. D	39. D
6. C	23. B	40. B
7. D	24. C	41. B
8. B	25. B	42. C
9. A	26. D	43. B
10. D	27. C	44. D
11. D	28. D	45. B
12. D	29. A	46. D
13. C	30. B	47. A
14. A	31. C	48. D
15. D	32. D	49. B
16. B	33. A	50. D
17. C	34. B	