TMSCA MIDDLE SCHOOL SCIENCE TEST #10 ©

FEBRUARY 3, 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 1.01	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

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1. What is the first amino acid encoded by all eukaryotic mRNAs
A) histidine **B)** adenine **C)** thymine **D)** methionine

2. Which of the following was NOT a component of the Earth's early atmosphere?
A) Oxygen **B)** Hydrogen gas **C)** Methane **D)** Ammonia

3. Mitosis is the process by which nuclei divide, creating two new nuclei, each with identical sets of DNA. Meiosis is the process that involves only which of the following types of cells?
A) skin cells **B)** sex cells **C)** Parenchyma cells **D)** Bacteria

4. Which of the following species would NOT thrive in a mangrove habitat?
A) Blue crabs **B)** Sea horses **C)** Alligators **D)** Anglerfish

5. What impurity found in coal contributes to acid rain?
A) Sulfur **B)** Hydrogen **C)** Carbon **D)** Chlorine

6. What is the name of the mechanism responsible for the evolution of a species?
A) natural selection **C)** adaptive radiation
B) inheritance of acquired characteristics **D)** none of the above

7. Which of the following is NOT an important component of the hydrologic cycle?
A) Transpiration **B)** Condensation **C)** Runoff **D)** Respiration

8. How many major phases does the Moon have?
A) 4 **B)** 6 **C)** 8 **D)** 10

9. Many ducks have oils on their feathers so that their feathers do not get wet. What type of interaction is occurring between the feathers and water?
A) Hydrophobic **B)** Hygroscopic **C)** Hydrophilic **D)** Heliophobic

10. Which of the following is a force that will always decrease the efficiency of a mechanical system?
A) Gravity **B)** Spring force **C)** Magnetic force **D)** Friction

11. Mendel's experiments crossing different colored pea plants demonstrated what genetic concept?
A) Haploid and diploid variation **C)** Gametophyte reproductive cycles
B) Recessive and dominant genes **D)** Mitotic division

12. What substances, by definition, produce ions when dissolved in water?
A) Electrolytes **B)** Elements **C)** Molecules **D)** Nonpolar

13. Why do noble gases almost never form chemical bonds?
A) It is difficult for gases to form bonds **C)** They have very small atomic radii
B) They have completely filled outer valence shells **D)** They are very rare

14. What is the primary component of natural gas?
A) Methane **B)** Helium **C)** Hydrogen **D)** Oil

15. On what part of the Earth does every day have exactly the same number of hours of day and night?
A) south pole **B)** north pole **C)** prime meridian **D)** equator

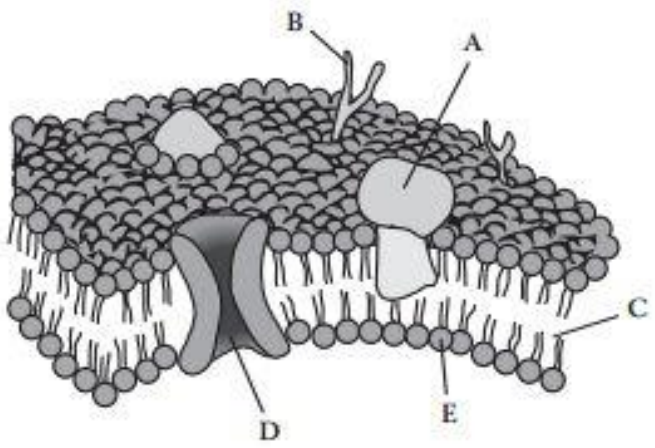
16. The majority of ocean organisms living in hydrothermal vents are believed to be which of the following?
A) Protists **B)** Coral **C)** Bacteria **D)** Eels

17. If a fireman turns on his water hose and is knocked backwards; of which of Newton's three laws of motion is this an example?
A) Newton's 1st law **B)** Newton's 2nd law **C)** Newton's 3rd law **D)** Newton's 4th law

18. What is the term for a chemical reaction that absorbs heat as the reaction proceeds?
A) endothermic **B)** exothermic **C)** catabolic **D)** exergonic

19. The kingdom Plantae [PLAN-tee] consists of members that are which of the following?
A) Non-photosynthetic, multicellular, and eukaryotic
B) Photosynthetic, multicellular, and eukaryotic
C) Photosynthetic, multicellular, and prokaryotic
D) Photosynthetic, unicellular, and prokaryotic

20. In the diagram of the plasma membrane shown below, what structure is indicated by the letter E?



A) protein **B)** sugar **C)** phosphate **D)** lipid

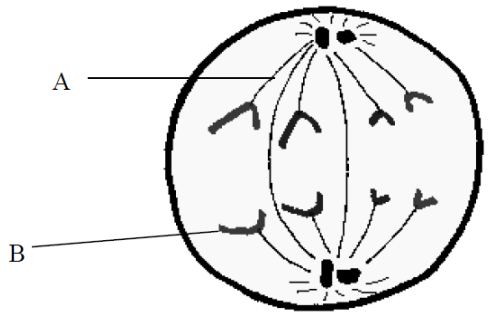
21. As a swing rises in the air, which of the following types of energy increases in the rider?
A) Kinetic **B)** Thermal **C)** Potential **D)** Mechanical

22. Which of the following is NOT one of the properties of forces?
A) Net forces always change velocity
B) Forces can cause a change in motion
C) Forces can cancel each other out
D) Forces in opposite directions always result in an unbalanced net force

23. Bats use what system to navigate in darkness?
A) Echolocation **B)** Sound waves **C)** Radar **D)** Vibration

24. Different forms of genes are known as
A) alleles. **B)** chromatids. **C)** epigenetics. **D)** kinetochores.

25. In the image below, "B" is what structure?



A) chromosome **B)** metaphase plate **C)** microtubule **D)** centriole

26. After vigorous activity, you would expect the blood leaving the muscle to have
A) less carbon dioxide and more glucose.
B) more carbon dioxide and less glucose.
C) less oxygen and less carbon dioxide.
D) more oxygen and more glucose.

27. In a pedigree, a shaded in square would indicate
A) a male with the genetic condition.
B) a female without the genetic condition.
C) a male without the genetic condition.
D) a female with the genetic condition.

28. What is the mRNA codon for the following DNA triplet, ATC?
A) TAG **B)** ATC **C)** UTG **D)** UAG

29. The human red blood cell is surrounded by what type of solution within our bodies?
A) hypertonic **B)** isotonic **C)** hypotonic **D)** crenate

30. The mitochondria generates energy in the form of
A) ATP **B)** NADPH **C)** sugar **D)** lipids

31. A tapeworm feeding on the nutrients in the small intestine would be considered a
A) mutualistic relationship.
B) commensalism relationship.
C) parasitic relationship.
D) homologous relationship.

32. Which of the following would you not find in a virus?
A) protein coat **B)** DNA **C)** RNA **D)** mitochondria

33. What is true about the relationship between cells and the organism they are part of?

A) Cells make up the basic structure of an organism, and they perform basic life functions for the organism.
B) Cells make up the basic structure of an organism, but they do not perform basic life functions for the organism.
C) Cells perform basic life functions for the organism, but they do not make up the basic structure of an organism.
D) Cells do not make up the basic structure of an organism, and they do not perform basic life functions for the organism.

34. Red blood cells carry oxygen. Which of the following types of cells use oxygen carried by red blood cells?

A) Both muscle cells and nerve cells
B) Muscle cells, but not nerve cells
C) Nerve cells, but not muscle cells
D) Neither muscle cells nor nerve cells

35. In sexually reproducing organisms, such as humans, which of the following is TRUE about the DNA in each of the body cells (any cell in the body except a sex cell) of a daughter and her father?

A) Less than 50% of the DNA in each of the daughter's body cells is from her father.
B) Exactly 50% of the DNA in each of the daughter's body cells is from her father.
C) More than 50% of the DNA in each of the daughter's body cells is from her father.
D) Each type of body cell in the daughter contains a different amount of DNA from her father.

36. Which of the following can limit the growth of a population of organisms?

A) Both the number of predators and diseases can limit the growth of a population of organisms.
B) The number of predators can limit the growth of a population of organisms, but diseases cannot.
C) Diseases can limit the growth of a population of organisms, but the number of predators cannot.
D) Neither the number or predators nor diseases can limit the growth of a population of organisms.

37. Which of the following is TRUE about genes?

A) Genes are traits.
B) Genes are proteins.
C) Genes are sequences of nucleotides.
D) Genes are sequences of amino acids.

38. Which of the following statements is TRUE about the carbon dioxide that is used by plants?

A) It is combined with oxygen to make sugar molecules.
B) It is absorbed through the roots of plants.
C) It comes from the air.
D) It is food for plants.

39. What happens as liquid water boils?

A) The molecules are destroyed.
B) The molecules break down into hydrogen and oxygen atoms.
C) The molecules become separated from each other.
D) The mass of the molecules decreases.

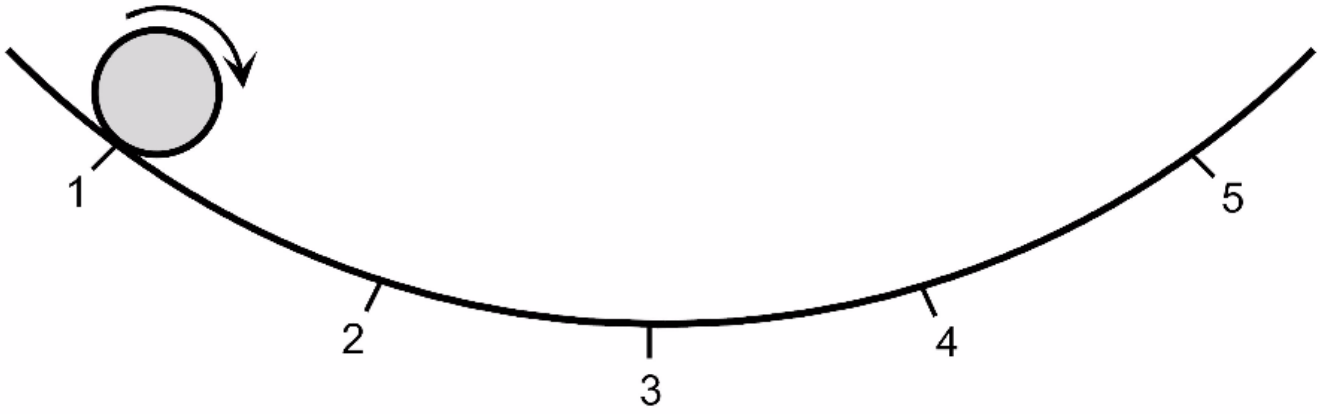
40. Which of the following is an example of a chemical reaction?

A) Aluminum foil being cut into smaller pieces
B) A drop of food coloring dissolving in water
C) Melted butter becoming a solid when placed in the refrigerator
D) The surface of a copper penny changing color after being in a drawer for year

41. You find an object that is made of a pure metal. What could you do to identify which metal the object is made of?

A) Determine its melting point and compare it to the melting point of other metals.
B) Measure its length and compare it to the length of other metals.
C) Determine its shape and compare it to the shape of other metals.
D) Measure its mass and compare it to the mass of other metals.

42. A ball, starting from rest at Position 1, rolls down and then up a curved track towards Position 5. The ball speeds up as it rolls from Position 1 to Position 3, and it slows down as it rolls from Position 3 to



Position 5. When it reaches Position 5, it rolls back down the track. When is the motion energy (kinetic energy) of the ball being transformed into gravitational potential energy?

A) Only when the ball rolls from Position 1 to Position 3
B) Only when the ball rolls from Position 3 to Position 5
C) The entire time the ball is rolling from Position 1 to Position 5
D) It is not being transformed at any time because motion energy (kinetic energy) cannot be transformed into gravitational potential energy.

43. Is energy transformed while a rock is falling from a cliff? Explain.

A) Yes, motion energy (kinetic energy) is transformed into gravitational potential energy as the rock falls.
B) Yes, gravitational potential energy is transformed into motion energy (kinetic energy) as the rock falls.
C) No, because the rock lost all of its gravitational potential energy once it started to move.
D) No, because one form of energy cannot be transformed into another form of energy.

44. Which of the following describes what happens as a substance changes state?

A) The type of molecules of the substance changes.
B) The mass of the molecules of the substance changes.
C) The shape of the molecules of the substance changes.
D) The connection between molecules of the substance changes.

45. What is the maximum number of electrons that can occupy the second energy level of an atom?

A) 2 **B)** 4 **C)** 8 **D)** 16

46. In which set do the elements exhibit the most similar chemical properties?

A) Li, Be, and Ra **B)** Si, B, and He **C)** Ca, Sr, and Ba **D)** Ar, Zr, and Ir

47. When a body of air can hold no more water vapor, it is referred to as being what?

A) saturated **B)** humid **C)** dry **D)** meteorology

48. What actually causes the Northern Lights?

A) light passing through pollution in the atmosphere
B) electrons from solar winds
C) reflection of lights off glaciers
D) light refraction off water vapor

49. What kind of weather does a cold front usually bring?

A) warm **B)** stormy **C)** gentle rain **D)** sunny

50. What is the most common element in the Universe?

A) hydrogen **B)** helium **C)** oxygen **D)** iron

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