



TMSCA MIDDLE SCHOOL SCIENCE TEST #9 © JANUARY 27, 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, ln x, 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 $\pm 5\%$ 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 1.008	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, $g = 9.81 \text{ m/s}^2$

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

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

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

Standard temperature and pressure (STP) is 0°C and 1 atmosphere

Gram molecular volume at STP = 22.4 liters

Velocity of light, $c = 3.0 \times 10^8 \text{ m/sec}$

Absolute zero= $0 \text{ K} = -273.15^\circ\text{C}$

Gas constant, $R = 1.986 \text{ cal/K}\cdot\text{mole} = 0.082 \text{ liter}\cdot\text{atm/K}\cdot\text{mole}$

One Faraday= 96,500 coulombs ($9.65 \times 10^4 \text{ C}$)

Dulong and Petit's constant= $6.0 \text{ amu}\cdot\text{cal/gram}\cdot\text{K}$

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

Atomic mass unit, $m_u = 1.66 \times 10^{-27} \text{ kg}$

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

Permittivity of free space $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{N}\cdot\text{m}^2$

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

1 Atmosphere= $1.02 \times 10^5 \text{ N/m}^2 = 760 \text{ Torr} = 760 \text{ mmHg}$

1 Electron Volt - $1.6 \times 10^{-19} \text{ Joules}$

Charge of an electron= $-1.6 \times 10^{-19} \text{ coulombs (C)}$

1 horsepower (hp) = 746 W = 550 ft•lb/s

Neutron Mass= 1.008665 au

Proton Mass= 1.007277 au

1 au= 931.5 MeV

1 calorie= 4.184 Joules (J)

Specific heat of water= $4.18 \text{ J/g}\cdot^\circ\text{C}$

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1. Which of the following is the study of butterflies:
A) arachnology **C)** planktology
B) dendrochronology **D)** lepidopterology
2. Which of the following is a heterogeneous mixture:
A) 5.0% glucose solution **C)** mixture of hydrogen and oxygen gases
B) rubbing alcohol **D)** concrete
3. Which of the following is a lipid:
A) lipase **B)** myoglobin **C)** trypsin **D)** corn oil
4. Nitrogen, sulfur, and selenium are all:
A) metals **B)** nonmetals **C)** metalloids **D)** noble gases
5. Which of the following is a volcanic rock that is so lightweight that it can sometimes float on water:
A) obsidian **B)** pitchstone **C)** pumice **D)** basalt
6. How many heart chambers does a dolphin have?
A) 3 **B)** 4 **C)** 2 **D)** 1
7. Ignoring friction, what is the acceleration, in meters per second squared, when 1,000 newtons of force are applied to move a 200-kilogram crate across a level floor?
A) 5 m/s² **B)** 100 m/s² **C)** 110 m/s² **D)** 50 m/s²
8. What scientist is sometimes considered the father of genetics because of his extensive studies on the patterns of inheritance?
A) Mendel **B)** Darwin **C)** Malthus **D)** Griffith
9. Which of the following BEST describes the SI unit called the Newton:
A) a unit of power **B)** a unit of force **C)** a unit of work **D)** a unit of energy
10. In which of the following areas of the human body would you find the patella?
A) knee **B)** foot **C)** elbow **D)** ribs
11. Which of the following is generally NOT true:
A) the boiling point of water decreases with increased altitude on Earth **C)** radon is radioactive
B) the melting point of table salt is much higher than that of glucose **D)** metals react with nonmetals to form new metals
12. What is the percent efficiency, rounded to the nearest whole number, of a simple machine that requires 600 joules of energy input to achieve 400 joules of energy output?
A) 24% **B)** 40% **C)** 67% **D)** 30%
13. Which of the following most likely made the trip from Europe to the New World possible for early sailors:
A) the westerlies **C)** the doldrums
B) the trade winds **D)** the jet stream

14. What anatomical structure in boney fish allows them to adjust their buoyancy and stay afloat without swimming?
A) swim bladder B) operculum C) dorsal fin D) anal fin
15. What is the resultant force when a force of 50 Newton's is opposed in an opposite direction by a 10-Newton force?
A) 60 B) 5 C) 20 D) 40
16. What is the most common name of the plant pigments that give fruits and many plant parts their orange color?
A) chlorophyll B) carotenoids C) rhodopsin D) xenophyll
17. Arrange the 4 substances into decreasing pH; water, HCl, bleach, human saliva.
A) bleach; human saliva; water; HCl C) water; bleach; human saliva; HCl
B) HCl; human saliva; water; bleach D) bleach; water; human saliva; HCl
18. How many wavelengths per second are equal to 5 kilohertz?
A) .005 B) 500 C) 50 D) 5000
19. What is the percent efficiency for a lever that has a work input of 2,000 joules and a work output of 1,600 joules?
A) 80% B) 90% C) 100% D) 20%
20. Cartilage belongs to which of the following animal tissues types:
A) epithelial B) connective C) nervous D) muscle
21. Of all the essential minerals present in the human body, which one is the most abundant?
A) magnesium B) zinc C) iron D) calcium
22. Which of the following is most directly responsible for the exchange of genes during meiosis:
A) crossing over B) kinetochores C) cytokinesis D) alleles
division
23. Which of the following is a phenomenon associated with extensive warming of the ocean in the tropical regions of the eastern Pacific:
A) El Nino B) a Chinook C) La Nina D) the Ekman spiral
24. Locked jaw is a complication caused by a:
A) bacteria B) virus C) protozoan D) fungi
25. Binary fission and budding are best known as
A) sexual reproduction C) crossing over
B) asexual reproduction D) mitosis
26. An Olympic runner braces himself against a stationary set of foot blocks and accelerates with a horizontal magnitude of 2 meters per second squared. How many Newton's of horizontal force does the runner exert on the blocks to produce this acceleration if his mass is 70 kilograms?
A) 100 N B) 140 N C) 35 N D) 70 N

27. What is the correct binomial scientific genus and species name for humans?
A) *Homo sapiens* B) homo sapiens C) *Homo Sapiens* D) Homo Sapiens
28. Exposure to sunlight converts cholesterol found in human skin into what vitamin?
A) Vitamin D B) Calcium C) Magnesium D) Vitamin A
29. Which of the following metals is attracted to a magnet?
A) gold B) silver C) iron D) aluminum
30. What main artery carries oxygenated blood immediately away from left ventricle of the heart?
A) vena cava B) artery C) aorta D) ventricle
31. What is the vector that transmits Rocky Mountain Spotted Fever to humans?
A) tick B) mosquito C) flea D) rat
32. The structure of DNA proposed by Watson and Crick was partly based on the x-ray work of:
A) Louis Pasteur C) Linus Pauling
B) Rosalind Franklin D) Eleonore Rubinstein
33. Monera was once known as a
A) kingdom B) phylum C) trophic level D) genus
34. S-waves produced by earthquakes, do not travel through the Earth's:
A) crust B) mantle C) outer core D) lithosphere
35. If a 90 kilogram object displaces 30 kilograms of water when immersed, what will its apparent weight be?
A) 120 kg B) 60 kg C) 90 kg D) Unknown
36. The spines of cacti are a modification of what plant structure?
A) leaf B) petal C) flower D) root
37. A person who had polydactylia would have too many of what?
A) digits B) lung lobes C) ovaries D) appendages
38. Which of the following components corresponds to the pitch of a sound wave:
A) wavelength B) frequency C) amplitude D) speed
39. In a closed container, if a gas is heated, which of the following occurs:
A) molecular motion will decrease C) the chemical properties will change
B) the gas will condense on the inner walls of the container D) the pressure will increase
40. The property of water which permits an insect to "walk" on water is:
A) viscosity C) tensile strength
B) surface tension D) turgor pressure

41. Which of the following is primarily involved in the movement of a glacier:
A) running water
B) ambient temperature
C) topology
D) gravity
42. Doing a given amount of work at different rates always involves a different amount of:
A) mass
B) efficiency
C) potential energy
D) power
43. Which of the following is the actual location where slippage of rock masses first occurs in an earthquake:
A) seismic front
B) focus
C) Richter point
D) foreshock
44. What is the proper sequence of the phases of mitosis?
A) prophase, anaphase, metaphase, telophase
B) telophase, metaphase, anaphase, prophase
C) prophase, metaphase, anaphase, telophase
D) metaphase, anaphase, prophase, telophase
45. Which of the following is a diatomic molecule?
A) H₂O
B) methane
C) H₂
D) NaCl
46. Which of the following describes a liquid in which visible particles settle?
A) Solution
B) Homogeneous mixture
C) Colloid
D) Suspension
47. Calculate the density of an object, in grams per cubic centimeter, from the following information: When an object with a mass of 25 grams is placed in a graduated cylinder filled with water, the water level changes from 12.8 to 15.3 cubic centimeters.
A) 15 g/cm³
B) 20 g/cm³
C) 10 g/cm³
D) 30 g/cm³
48. Which of the following is a phylum of plants that is characterized by naked or uncovered seeds?
A) Gymnosperms
B) Angiosperms
C) Algae
D) Monocots
49. What do scientists call the current produced when wave water flows rapidly back to the ocean through a break in a sandbar?
A) Rip tide
B) Longshore current
C) Tidal bore
D) High tide
50. A chisel would represent what type of simple machine?
A) Pulley
B) Wedge
C) Lever
D) Screw

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