

TMSCA MIDDLE SCHOOL SCIENCE WIGGS INV TEST © 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, 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 1 H 1.01	2A 2 4 He 4.00											3A 13 5 B 10.81	4A 14 6 C 12.01	5A 15 7 N 14.01	6A 16 8 O 16.00	7A 17 9 F 19.00	8A 18 10 Ne 20.18
3 Li 6.94	4 Be 9.01											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
11 Na 22.99	12 Mg 24.31	3B 3 21 Sc 44.96	4B 4 22 Ti 47.87	5B 5 23 V 50.94	6B 6 24 Cr 52.00	7B 7 25 Mn 54.94	8 8 26 Fe 55.85	9 9 27 Co 58.93	10 10 28 Ni 58.69	11 11 29 Cu 63.55	12 12 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
19 K 39.10	20 Ca 40.08	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, $g = 9.81 \text{ m/s}^2$

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

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 Pelil'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) = $746 \text{ W} = 550 \text{ ft}\cdot\text{lb/s}$

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 = $4.18 \text{ J/g}\cdot^\circ\text{C}$

2019-2020 TMSCA Middle School Science Wiggs INV Test

1. Which of the following results in energy without the use of oxygen?

- A. anerobic cellular respiration
- B. fermentation
- C. aerobic cellular respiration
- D. Both A and B



2. Which of the following is true about fungi?

- A. produce numerous seeds
- B. grow only in dark places
- C. grow best in alkaline soil
- D. feed on organic material

3. What shape would the bacterium with “cocci” in its name mostly be?

- A. spiral
- B. spherical
- C. cylindrical
- D. cubic

4. What contains the genetic information in cells?

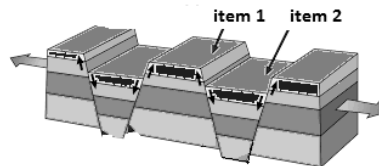
- A. deoxyribonucleic acid
- B. ribonucleic alkali
- C. distinctive nucleic acid
- D. karyotype

5. The planet with about 96.5% CO₂ in the atmosphere is what?

- A. Earth
- B. Venus
- C. Jupiter
- D. Saturn

6. This diagram demonstrates the topography of a “horst” and another landform. Death Valley is an example of this type of valley. What is the name of item 2 in this diagram?

- A. archipelago
- B. spit
- C. graben
- D. shoal



7. Which formula is correct for calculating force?

- A. $F = ma$
- B. $F = m/a$
- C. $F = d/t$
- D. $F = m - a$

8. A physical property of minerals includes “diaphaneity”.

What would be an example of this property?

- A. Hematite is not magnetic even though it contains iron.
- B. Halite has a salty taste.
- C. Mica has basal cleavage and peels into sheets.
- D. Calcite will allow light to pass through at a translucent to transparent level.

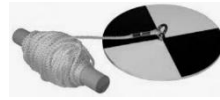
9. Which word pair below is incorrectly matched?
- A. acoustics – sound
 - B. quantum mechanics – subatomic particles
 - C. thermodynamics – optics
 - D. aerodynamics – air motion
10. When measuring “power” in SI units, you should use what unit and symbol?
- A. farad – F
 - B. ohm - Ω
 - C. watt – W
 - D. pascal – Pa
11. Two students devised a way to measure the volume of a small bead with an irregular shape. First, they filled a beaker with 100mL of water. Second, they placed 100 of the identical irregular shaped beads in the beaker of water until all were submerged. Third, they noted the water level now to be at the 145mL mark on the beaker. What would they do next to calculate the volume of one single bead?
- A. Divide 145 by 100, volume equals 1.45 mL for each bead
 - B. Subtract 100 from 145, volume equals 45mL for each bead
 - C. Subtract 100 from 145, then divide by 100, volume equals .45 mL for each bead
 - D. Divide 145 by 100, plus the number of beads, volume equals 101.45 mL
12. About how many cells are in the adult human body based on density?
- A. 10 billion
 - B. 100 billion
 - C. 1 trillion
 - D. 100 trillion
13. A bacterium that has no flagella would have difficulty doing what?
- A. maintaining its shape
 - B. moving
 - C. making new cells
 - D. living
14. Is it possible for plants to get sick?
- A. No, plants do not get sick, they only wilt from lack of water.
 - B. Yes, plants can become sick from viruses, bacteria, and fungal diseases.
 - C. No, plants have a natural immunity to viruses, bacteria, and fungal diseases.
 - D. None of the above
15. In science, if the prefix “karyo” is used in a word, this tells you the word has to do with what?
- A. a wall
 - B. singing
 - C. orange square
 - D. cell nucleus

16. Which of the following would be considered an inorganic compound?
A. C_3H_8 B. C_2H_6 C. $C_6H_{12}O_6$ D. $CaCO_3$

17. Chemical Equations must be balanced _____.
A. so that the reaction doesn't explode
B. because the elements won't line up if it is not balanced
C. because of the law of conservation of mass
D. because bonding will not take place

18. The high school environmental science class does a monthly water test at a nearby lake. One tool that they use is a round disk, with alternating black and white on it. The disc is suspended from a rope so that it can be lowered down in the water to check for water transparency and depth. What is this tool called?

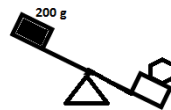
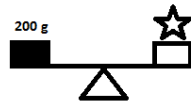
- A. Frisbee
- B. Perry Protractor
- C. Ditzel dial
- D. Secchi disk



19. An atom has an atomic mass of 59 and 32 neutrons. What element is this?
A. Cobalt B. Germanium C. Carbon D. Nickel

20. Which is older, a rock that formed in the Holocene, Miocene, or Eocene epoch?
A. Holocene B. Miocene C. Eocene D. none of the above

21. Out of the objects represented on these three identical balances, which of the objects has the most mass?



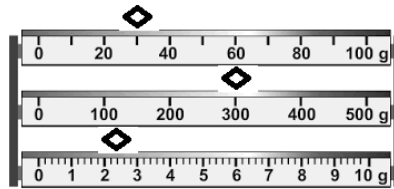
- A. ○
- B. ☆
- C. ⬡
- D. All have the same mass

22. Sasha was tracking the moon phases and just recorded the night's phase to be full moon. Out of the 8 main phases, what would come next?
A. half-moon B. waning crescent C. waxing gibbous D. waning gibbous

23. If these human cells were lined up side by side, which would be the longest?
A. keratinocytes B. muscle C. sciatic nerve D. leucocytes

24. The most geologic active region on Earth is considered to be what?
 A. the mountain peaks
 B. mile beneath the Earth
 C. the “Ring of Fire”
 D. California
25. “Crest” is to “trough” as “apogee” is to what?
 A. perigee B. trajectory C. parallel D. summit
26. The mass of a push lawn mower is about 60 lbs. About how many kg would that equal?
 A. 27 kg B. 130 kg C. 1,000 kg D. 3 kg

27. While measuring items in the lab,
 Item X on the triple beam balance
 read as shown in this photo.



What is its mass?

- A. 322.5 g
 B. 227.2 g
 C. 327.2 g
 D. 332.2 g
28. Clues: lower free water molecule concentration outside of the cell, water moves out of cell, cell shrinks in size What may have caused this?
 A. hypertonic solution
 B. hypotonic solution
 C. isotonic solution
 D. Both A and B
29. A food that is made from a plant that has undergone a technique that involves adding, deleting or altering genes in a lab is called a what?
 A. gluten B. GMO C. MSG D. psyllids
30. How many elements make up sodium bicarbonate (NaHCO₃)?
 A. 4 B. 5 C. 6 D. 7
31. Clues: American biologist, concerned with effects of human activities on wildlife, wrote the book *Silent Spring* which possibly led to development of Environmental Protection Agency
 What person is this?
 A. Francis Collins B. Charles Darwin C. Jane Goodall D. Rachel Carson
32. Sand beaches formed near the volcanic rocks, such as basalt in Hawaii can be found in what color?
 A. blue B. white C. black D. green

33. A golf ball with a mass of 45 g and a bowling ball with a mass of 5 kg are moving at the same velocity. Which of these has the most momentum?
- A. The golf ball and bowling ball have the same momentum.
 - B. They both have the same velocity and so their momentum is the same also.
 - C. No way of knowing unless you know are there to observe it.
 - D. The bowling ball has a greater mass; therefore, a greater momentum at the same velocity
34. The mass of a banana would be about what?
- A. 10 kg
 - B. 100 g
 - C. 10 g
 - D. 1 kg
35. Scientists have been researching insect egg shapes. Data has been collected on the egg shapes, such as small and round, asymmetrical, and large round egg types. In addition, data has been recorded to where the insects lay the eggs. What would be a reasonable hypothesis for this investigation?
- A. Insect eggs are laid in batches of 50.
 - B. Insect eggs laid in the water tend to be smaller and rounder.
 - C. Insect eggs laid in soil or leaf litter tend to be dark in color.
 - D. Insects lay eggs.
36. Complete this analogy – “steel beams” are to a “building” as “_____” is to a “cell”
- A. nucleus
 - B. mitochondrion
 - C. ribosomes
 - D. cytoskeleton
37. Clues: plant type, lack conducting tissues, includes mosses, liverworts, hornworts
What type of plant is this?
- A. gymnosperm
 - B. angiosperm
 - C. bryophytes
 - D. pteridophytes
38. How many valence electrons does neutral Helium have?
- A. 1
 - B. 2
 - C. 3
 - D. 4
39. Which “C” word below means a substance that can cause cancer?
- A. capsaicin
 - B. crepuscular
 - C. circadian
 - D. carcinogen
40. Scientists were studying two planets. They were contemplating the gravitational attraction between them. What two factors would they need?
- A. mass and state of matter that planets contain
 - B. mass of planets and distance between them
 - C. volume and molecular structure of each planet
 - D. size and shape of the planets
41. The Noble gases on the Periodic Table are found in what group?
- A. 7A
 - B. 6A
 - C. 1A
 - D. 8A

42. Which of the following is considered an herbaceous plant?
 A. prickly pear B. wild plum tree C. lotebush D. parsley
43. Barry is planning on finding out the similarities and differences of several types of light sources, such as a green laser, red laser, incandescent light, fluorescent light, black light, sunlight, mercury light, etc. What tool would be useful for his investigation?
 A. anemometer B. spectroscope C. psychrometer D. timing device
44. In physics, a law states that for a fixed amount of gas at a constant pressure, the volume of the gas increases as its temperature increases. What is the name of this law?
 A. Boyle's Law B. Pascal's Principle C. Murphy's Law D. Charles's Law
45. When a comet in orbit around the sun reaches approximately 3×10^8 km from the sun, the ice of the nucleus changes into a gaseous state which makes up the what?
 A. geminid B. chioma C. head D. tail
46. Lee was concerned about the number of calories in different types of cheese. He made a table and then wanted to see how many joules each would equal. (use the useful information chart as needed) How many Joules would 2 ounces of Mozzarella cheese equal?

- A. 351,456
 B. 351.456
 C. 702.912
 D. 702,912

Cheese Type	Number of kilocalories	Joules (J)
Feta	74 per ounce	309,616
Mozzarella	84 per ounce	?
Blue Cheese	99 per ounce	414,216
Cheddar	113 per ounce	?

47. The observation of pH involves what?
 A. the amount of salt in a substance
 B. the ability of a substance to dissolve
 C. the number of atoms of hydrogen that make up the substance
 D. the number of hydrogen ions or hydroxide ions in a solution
48. Which of the following would be considered a gymnosperm?



A.



B.



C.



D.

49. Beginning in the core of the sun, these particles then enter the radiative zone where they may stay a very long time. After the radiative zone, they enter the convection zone, the solar atmosphere, and then on through the sun's corona. Finally, this particle makes it way toward Earth, which takes only about 8 minutes, where they are absorbed, reflected, or scattered. What are they?
- A. electrons B. gnomons C. lumens D. photons
50. Which statement about calcium is not true?
- A. The chemical symbol for Calcium is "Ca"
B. Calcium is a member of Group 3
C. Calcium has an atomic number of 20.
D. Calcium's atomic mass is 40.08.

2019 - 2020 TMSCA Middle School Science Wiggs INV Test - Key

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