



TMSCA MIDDLE SCHOOL SCIENCE SUN RIDGE INVITATIONAL © 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 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 26 Fe 55.85	9 27 Co 58.93	10 28 Ni 58.69	11 29 Cu 63.55	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 = $4.18 \text{ J/g}\cdot^\circ\text{C}$

2018 TMSCA Middle School Science Sun Ridge Invitational Meet

1. What would be another characteristic of the compounds in class D?

Class of Compound	Characteristic
A	Has glycerol as a building block
B	Contains both acid groups and amino groups
C	Formed from subunits containing a nitrogenous base, ribose, and phosphate
D	Includes sugars and starches

- A) They are composed of basic compounds known as nucleotides. C) They transfer amino acids to ribosomes during protein synthesis.
- B) They contain the atoms of hydrogen and oxygen in a 2:1 ratio. D) They include chemical compounds such as insulin and estrogen.
2. The condition in which a gamete contains the $2n$, $3n$, $4n$ number of chromosomes is known as
 A) aneuploidy. B) polyploidy. C) haploidy. D) non-disjunction.
3. In the 1960's, a scientist named, J.B. Gurdon, worked with frog cell nuclei to produce
 A) sterile frogs. B) stronger, super frogs. C) identical frogs. D) a new species of salamander.
4. A type of chromosomal alternation in which a region of the chromosome breaks off and is lost is called
 A) addition. B) deletion. C) translocation. D) inversion.
5. The glucose molecules created during photosynthesis can be
 A) converted to cellulose by hydrolysis. C) used as a reactant for photosynthesis.
 B) used as a catalyst for metabolic activity. D) converted into glycogen.
6. In humans, the ureter is responsible for transporting urine from the
 A) blood to the kidney. B) kidney to the bladder. C) kidney to the liver. D) bladder to outside of the body.
7. Europa is a famous moon of what planet?
 A) Saturn B) Mars C) Neptune D) Jupiter
8. Of the following, which would you find in the ear?
 A) clavicle B) nephron C) alveoli D) cochlea
9. The length of a star's life cycle and the way a star changes depend on its
 A) composition. B) water content. C) mass. D) temperature.
10. Scientists use the _____ to help determine whether a galaxy is moving toward or away from the Earth.
 A) Doppler effect B) Boyles law C) gravitational pull D) Planck's constant

11. Nonmetals are usually
- A) a gas at room temperature. B) malleable and ductile. C) conduct electricity. D) none of the above.
12. What is the total number of protons contained in the nucleus of a carbon-12 atom?
- A) 8 B) 6 C) 12 D) 10
13. Elements in a given group of the Periodic Table contain the same number of
- A) protons in the nucleus. C) electrons in the outermost level.
B) neutrons in the nucleus. D) occupied principal energy levels.
14. As the elements in Group 15 are considered in order of increasing atomic number, which sequence in properties occurs?
- A) nonmetal → metalloid → metal C) metal → nonmetal → metalloid
B) metalloid → metal → nonmetal D) metal → metalloid → nonmetal
15. Which statement is an identifying characteristic of a mixture?
- A) A mixture can consist of a single element. C) A mixture must have a definite composition by weight.
B) A mixture can be separated by physical means. D) A mixture must be homogeneous.
16. What will happen to the atomic number of any given element as the number of neutrons in the nucleus increases?
- A) decrease B) increase C) stay the same D) not known
17. What is the maximum number of covalent bonds that an atom of carbon can form?
- A) 1 B) 2 C) 3 D) 4
18. What is the equivalent Kelvin temperature of 20°C?
- A) 273 K B) -273 K C) 293 K D) 20 K
19. Which element is an alkaline earth metal?
- A) Li B) Ba C) Zn D) Pb
20. Which of the following would be identified as a qualitative data?
- A) taste of an apple B) mass of a brick C) speed of a car D) time of a reaction
21. What is calculated by dividing the force a gas is exerting on a container by the area of the container?
- A) volume B) pressure C) density D) mass
22. Particles move fastest in
- A) liquid. B) gas. C) solid. D) not known
23. Ideally a machine will operate with a _____ efficiency.
- A) 1% B) 100% C) 90% D) 50%

24. The prefix *erythro-* used in science to form words such as erythrocyte means?
A) white B) red C) cell D) green
25. A “naked seed” plant is also known as a(n)
A) angiosperm. B) bryophyte. C) pteridophyte. D) gymnosperm.
26. A joule can be used to measure _____.
A) work B) power C) current D) speed
27. Which of the following is a base?
A) H_2SO_4 B) $MgCl_2$ C) CH_4 D) $NaOH$
28. The lower a pH of a substance is the more
A) hydronium ions are present. B) hydroxide ions are present. C) water can be formed. D) oxygen is present.
29. What is the appropriate unit of measurement for pressure?
A) N B) N/m C) m/s D) N/cm^2
30. What would be considered a more precise measurement?
A) 20 ml B) 20.0 ml C) .20 ml D) 20.01 ml
31. The rotating blade of a plane propeller has what kind of energy because of its motion?
A) gravitational B) potential C) kinetic D) thermal
32. What is the best description for the following: a car drives north at a constant 60 mph.
A) acceleration C) speed
B) velocity D) none of the above
33. If the velocity of an object increases, but the mass stays the same how will the momentum be affected?
A) Momentum will decrease C) Momentum will not change
B) Momentum will increase D) Momentum will decrease by half
34. In an ecosystem where a species of fox is already at its carrying capacity, what would the introduction of a competing species do to the carrying capacity of the fox?
A) increase B) decrease C) stay the same D) die off
35. Examples of igneous rock would include the following except:
A) granite B) pumice C) obsidian D) shale
36. The acceleration of ball that rolls across the floor at a steady rate of 0.2 m/second is _____.
A) $0\ m/s^2$ B) $0.2\ m/s^2$ C) $0.2\ m/s$ D) $0.4\ m/s^2$
37. What is the name given for the event that occurs in the Northern Hemisphere around June 21?
A) vernal equinox B) summer solstice C) winter solstice D) autumn equinox

38. A nerve net is found in what kind of organism?
A) jellyfish **B)** amoeba **C)** bacteria **D)** cod
39. If a book sitting on a table is pushed by Jill with 10 N of force across the table and pushed back by Jack with 20 N of force , the book will
A) move towards Jill . **C)** stay still.
B) move towards Jack. **D)** be pushed down to the table.
40. An area of land that separates waters that flow into different rivers is called a(n)
A) watershed. **B)** delta. **C)** estuary. **D)** channel.
41. The frequency of a wave is measured in
A) meters. **B)** meters/second. **C)** joules. **D)** Hertz.
42. The last quarter moon is also known as a
A) new moon. **B)** half moon. **C)** waxing gibbons. **D)** waxing crescent.
43. How many kilograms are there in 5.24 pounds? (2.2 lbs= 1 kg)
A) 11.53 **B)** 2.38 **C)** 4.19 **D)** 0.419
44. Elastic potential energy is shown in which of the following?
A) riding a bike **C)** hitting a cue ball
B) stirring a cup of tea **D)** stretching a rubber band
45. Directly below the lithosphere of the Earth’s crust is the
A) chromosphere. **B)** asthenosphere. **C)** mesosphere. **D)** core.
46. As the oceanic lithosphere subducts underneath the continental lithosphere
A) island volcanism **B)** oceanic ridges **C)** mountains rise. **D)** faults form.
forms. form.
47. For an individual to have a recessive trait such as blue eyes their genotype must be
A) AA **B)** Aa **C)** aa **D)** aA
48. If you turn a light on the light bulb is converting _____ energy to _____ energy.
A) electrical, light **C)** electrical, kinetic
B) chemical, kinetic **D)** electrical, chemical
49. A wave with higher energy would have which of the following?
A) a greater **B)** a lower **C)** a lower **D)** a greater
amplitude amplitude frequency wavelength
50. When the direction of light changes as it enters or exits a material such as water or glass is called
A) reflection. **B)** diffraction. **C)** refraction. **D)** transverse.

2018 TMSCA Middle School Science Test Sun Ridge Invitational

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