TMSCA MIDDLE SCHOOL SCIENCE TEST#5 ©

NOVEMBER 14, 2020

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. Look at this chart with involving electrical terms. There is a mistake. What is it?

Name	Measures	Symbol
Volt	Electric potential difference (voltage)	V
Ampere	Electric current	A
Watt	Power	W
Coulomb	Charge	C
Ohm	Electrical unit of resistance	Ω
Hertz	decibels	Hz

A. Volt measures charge, not electric potential difference.
B. A coulomb measures power not charge.
C. The symbol for Ohm should be O.
D. Hertz measures frequency not decibels.

2. What is the brightest star we see in Earth's sky?
A. Polaris B. Sirius C. our Sun D. Vega

3. Look at the photo of a juvenile yellow-crowned night heron. What does it eat and where does it hunt (according to legs and bill shape)?

A. seeds on tall grasslands
B. snakes in a desert environment
C. insects found in tree cavities
D. aquatic species in wetland areas

4. How do geologists currently study about the Earth's interior?
A. drilling down to the core
B. seismic wave results
C. pressure and heat protected cameras
D. geologist do not study the Earth's interior at all

5. What do you call a coarse sandstone rock that forms in a dry climate? (25% or more of it is feldspar with some quartz and mica)
A. quartzite B. arkose C. granite D. chert

6. Which of the following is not a group of sedimentary rocks?
A. organic B. chemical C. intrinsic D. detrital

7. Which list below show the human body's first built in defense against pathogens?
A. receptor proteins, and personal protection equipment
B. T-cells, B-cells, antibiotics
C. skin, mucous, oil and sweat
D. hand washing, alcohol wipes

8. The spinal cord is responsible for all of the following except which one?
   A. connects the brain to the peripheral nervous system
   B. helps to control reflexes
   C. controls long-term memory function
   D. contains a core of gray matter covered by a sheath of white matter

9. Students were measuring pH of the water after a rain. What is pH?
   A. A measure of the salts within a solution
   B. A measure of the conductivity of water based on hydrogen ions
   C. Number from 0-14 describing the acid in the water
   D. The relative measure of hydrogen ion concentration within a solution

10. An object that has a mass of 55 kg is placed on a shelf 2 meters off the ground. What is its gravitational potential energy? gravitational PE = mass(kg) x 9.8 m/s^2 x height(m)
   A. 1078 J B. 550 J C. 110 J D. none of these

11. The chemical composition for chert is which of the following?
   A. $CaSO_4$ B. H_2O C. CO_2 D. SiO_2

12. Which of the following is not true?
   A. Earth's magnetic field helps to protect us from solar storms.
   B. Satellites can operate in the Van Allen belts.
   C. It is possible for astronauts to be exposed to radiation in space.
   D. Particles in the radiation belts can travel faster than the speed of light.

13. When building an electrical circuit, the circuit must be what in order to complete the task intended?
   A. insulated B. closed C. open D. parallel

14. Which list below shows the metals in order from most dense to least dense (using the chart above)?
   A. aluminum, zinc, nickel, lead
   B. zinc, lead, nickel, aluminum
   C. nickel, lead, aluminum, zinc
   D. lead, nickel, zinc, aluminum

Metal	**Principal Ore**	**Density**
Aluminum	Bauxite	2.7 g/cm^3
Lead	Galena	11.34 g/cm^3
Nickel	Pentlandite	8.9 g/cm^3
Zinc	Sphalerite	7.14 g/cm^3

15. Which of the following is true about tornados?
   A. sometimes tornados are called meteotsunami
   B. the duration of tornados is 10 to 20 minutes
   C. tornados are measured using the Fujita scale
   D. a tornado on land is called a "dust devil"

16. I came up with the theory that equal volumes of gas with the same pressure and temperature have the same number of molecules. I discovered that elements can exist as molecules, not just single atoms. They named a special number after me. Who am I?

$6{,}023 \cdot 10^{23}$

A. Avogadro
B. Pascal
C. Priestley
D. Newton

17. The amount of heat per unit mass needed to raise the temperature of a substance by 1 degree Celsius is called the what?

A. specific heat B. potential energy C. convectional factor D. coulomb

18. Resistance to a particular disease is called what?

A. immunity B. autoimmune response C. reticent D. antigens

19. One supporting reason that scientists believe that the Earth's outer core is liquid is because of what?

A. P-waves can travel through liquid and S-waves cannot.
B. They do not believe that the Earth's outer core is a liquid.
C. The Earth rotates on its axis.
D. The Earth's magnetic field is caused by iron and nickel in Earth's core.

20. If a solution has a pH of 2, this means the solution is what?

A. Slightly basic
B. Slightly acidic
C. More basic than acidic
D. Dangerously acidic, do not touch

21. I discovered X-rays and won the first Nobel prize for physics. Who am I?

A. Curie B. Venter C. Priestley D. Roentgen

22. Daniel and Jose were discussing how far it is to the moon from Earth. Daniel said that he read that the earth was 405,500 km from the moon. Joe said that he was sure the moon was 363,300 km from the Earth. Who is correct?

A. Daniel is the only one who is correct because of measurements taken by lasers.
B. Jose is the only one who is correct because his source was more accurate.
C. Neither one is correct because the moon is 93,000,000 miles from Earth.
D. Both are correct depending on when the measurement was taken in the moon's orbit

23. What can help to produce long-term immunity to pathogens?

A. vaccination B. memory cells C. interferon D. Both A and B

Element	Volume	Mass
Gold	2 cm^3	38.56 g
Lead	1 cm^3	11.342 g
Uranium	3 cm^3	57 g
Osmium	1 cm^3	22.6 g

24. Out of the following elements on this chart, which has the greatest density?
    A. Pb B. Au C. Ur D. Os

25. Which statement below about genetics is not true?
    A. Transcription takes place inside the nucleus of a cell.
    B. Translation takes place outside the nucleus of a cell.
    C. There are 23 pairs of chromosomes in human sex cells.
    D. A protein is a compound made from one or more chains of amino acids.

26. Millipedes belong to the Class – Diplopoda. What must organisms in this class have?
    A. one pair of legs on each of the body segments
    B. two pair of legs on body segments for a total of 1,000 legs.
    C. two legs that are specialized for climbing
    D. two pair of legs on all but the first 3 body segments

27. What is weather?
    A. the condition of the atmosphere at a given place and time
    B. the long-term conditions of the atmosphere in an area
    C. the temperature of the air
    D. the amount of precipitation in an area over time

28. All of these make good insulators for electricity except for which one?
    A. glass B. sea water C. dry wood D. diamond

29. Which of the following is not true about minerals?
    A. Minerals are naturally occurring.
    B. Minerals have a crystal structure.
    C. Minerals are solid at room temperature.
    D. Minerals are only made of one element

30. The dusty soil formed from rock that is crushed by a blast of micrometeorites on the moon's surface is called what?
    A. regolith B. lateric C. loam D. humus

31. What organelle is the cell is the "powerhouse" of the cell?
    A. mitochondrion B. vacuole C. nucleus D. lysosome

32. Which of the following statements is true about geologic areas formed from evaporated seawater?

A. When the water evaporates, the minerals in the water precipitate at the same time.

B. When the water evaporates, the minerals in the water precipitate in a sequence determined by their solubility in the water.

C. When the water evaporates, the minerals in the water will not precipitate until the evaporation rate reaches at least 90%

D. The water evaporates, the minerals dissolved in the water will only precipitate when salt is present

33. Which list below describes the steps in the process of transcription in cells?

A. prophase, metaphase, anaphase, telophase

B. coding, decoding, expression

C. only one step, transcription

D. initiation, elongation, termination

34. The scientific name for the fungal disease called white-nose syndrome that is affecting bats is what?

A. *Pseudogymnoascus destructans*

B. *Colus pussilus*

C. *Ophryocystis elektroscirrha*

D. *Albinium bateotis*

35. Who is known as the "Father of Genetics"?

A. Robert Hooke B. Donald Herbert C. Thomas Hunt Morgan D. Gregor Mendel

36. When one egg cell is fertilized by one sperm cell and then the fertilized egg develops into two individuals, what results?

A. identical twins

B. fraternal twins

C. genetically different offspring

D. nothing, this is not possible

37. Agates can be amazingly beautiful rocks and are often polished and sold as jewelry. How does an agate form?

A. magma underground cools and hardens slowly creating beautiful rings

B. minerals in water evaporates in the bottom of an ancient sea

C. weathered particles are deposited and cemented into hardened rock

D. silica precipitates in concentric rings in voids found in rock

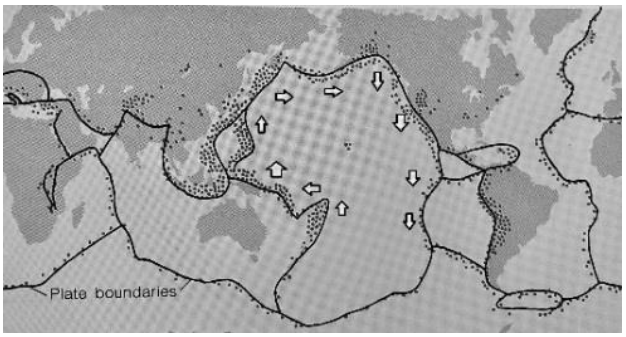
38. The ocean floor crust is relatively thin and made out of mostly what type of rock?

A. igneous rock B. granite C. basalt D. both A and C

39. Alexander finished his science project on the genetics of fruit flies. He needed to put his data in a graph. He wanted to graphically display the numbers of the different fruit flies with red eyes, and white eyes and whether they were male or female. What would be the recommended graph(s) to use for this data?

A. line graph B. bar graph C. pie graph D. either B or C

40. Look at area on this map marked with arrows. What statement below is true about this area?



A. it is an area with little volcanic activity
B. it shows an oceanic current
C. it is called the Ring of Fire
D. it is an area of stability on the crust

41. The Hertzsprung-Russell diagram is used to show what?

A. intrinsic brightness and surface temperature of stars
B. absolute magnitude and spectral type of stars
C. luminosity and surface temperature or color of stars
D. all of these

42. An atom that has lost or gained one or more electrons is known as a what?

A. isotope B. ion C. neutrino D. covalence

43. Carbon rich sedimentary rock belongs in what group?

A. detrital B. chemical C. organic D. there are no carbon rich rocks

44. In 1940, the Tacoma Narrows bridge began undulating and twisting to catastrophic failure. After investigation, it found to be due to amplification of vibration that occurs when an object absorbs energy at the objects' natural frequency, in this case, the wind was involved. What is this amplification called?

A. convectional stress force
B. resonance
C. sound resistance
D. refractional failure

45. Hawaiian Islands sit on what is called a "hot spot". In geological terms, this is what?

A. a place in which magma is at a subduction zone
B. a place where volcanism is caused by a rising convection plume on the mantle below
C. a place where tectonic plates meet with a divergent boundary
D. place in the Earth's crust where the temperature is unnaturally higher than the surrounding areas which causes unusual weather phenomenon

46. The students in science class were working on an activity. They put a deflated balloon on a balance scale and measured its mass. Next, they inflated the balloon and placed it on the balance scale to measure its mass. Next, they subtracted the mass of the deflated balloon from the mass of the inflated balloon. They wrote down the difference. The teacher asked them what they learned. What would be the best answer to respond?

A. Because the difference was 0, air has no mass and therefore, is not considered to be matter.

B. The difference that was calculated is the mass of the air in the balloon. This shows that air has mass and also volume; therefore, the air is matter.

C. Balloons when inflated weight the same no matter how much air they contain.

D. The air in the balloon is not matter because it took up space in the balloon.

47. Which neighbor planet of Earth rotates in the opposite direction of Earth?

A. Venus B. Mars C. Moon D. Mercury

48. A collapsing cloud of gas and dust that is destined to become a star is called what?

A. protostar B. quasar C. pulsar D. white dwarf

49. Atoms that have the same number of protons, but different number of neutrons are called what?

A. isotope B. ion C. unstable D. covalent

50. Neutral massless atomic particles that travel at the speed of light are called what?

A. ions B. neutrinos C. neutrons D. flash

2020 - 2021 TMSCA Middle School Science Test #5 - Key

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