The 2023 M Contest consist of 60 questions with each question counting five (5) points. Total Possible points is 300.

Atmosphere Questions

The five main layers of the atmosphere around the earth are:

1. Troposphere   2 Stratosphere 3. Mesosphere   4. Thermosphere and 5. Exosphere.

1. Which one of the five listed above contains more of our ozone layer? Answer: _____

(a) Troposphere   (b) stratosphere   (c) Mesosphere   (d) Thermosphere   (e) Exosphere.
Answer = (b)

2. The International Space Station (ISS) orbits mostly in which of the above five atmosphere layers? Answer= _____

(a) Troposphere   (b) stratosphere   (c) Mesosphere   (d) Thermosphere
        (e) Exosphere.
Answer = (e)

3. The _____ is the part of the earth's atmosphere in which ionization of atmospheric gases affects the propagation of radio waves.

(a) Troposphere   (b) stratosphere   (c) Mesosphere   (d) Thermosphere
        (e) none of these.
Answer = (e) actual answer ionosphere which includes mesosphere, thermosphere and exosphere.

4. which layer of the earth`s Atmosphere is the coldest? Answer: _____

(a) Troposphere   (b) stratosphere   (c) Mesosphere
(d) Thermosphere   (e) Exosphere.
Answer = (c)

5. which layer of the earth`s Atmosphere is the hottest? Answer: _____

(a) Troposphere   (b) stratosphere   (c) Mesosphere   (d) Thermosphere   (e) Exosphere.
Answer = (d)

6. The boundary between the mesosphere and the stratosphere is called the _____

(a) stratopause   (b) mesopause (c) The ozone boundary   (d) Ionic Magneto   (e) None of these
Answer = (a)

7. The boundary between the mesosphere and the thermosphere is called the _____

(a) menopause   (b) stratosphere line   (c) Mesosphere line   (d) Thermosphere lineup   (e) mesopause

Answer = (e)

8. The outer edge of troposphere is approximately _____ km above the surface of the earth.

(a) 12 km   (b) 50 km   (c) 80 km   (d) 700 km   (d) 10,000 km

Answer = (a)

9. The outer edge of stratosphere is approximately _____ km above the surface of the earth.

(a) 12 km   (b) 50 km   (c) 80 km   (d) 700 km   (d) 10,000 km

Answer = (b)

10. The outer edge of Mesosphere is approximately _____ km above the surface of the earth.

(a) 12 km   (b) 50 km   (c) 80 km   (d) 700 km   (d) 10,000 km

Answer = (c)

11. The outer edge of Thermosphere is approximately _____ km above the surface of the earth.

(a) 12 km   (b) 50 km   (c) 80 km   (d) 700 km   (d) 10,000 km

Answer = (d)

12. The outer edge of Exosphere.is approximately _____ km above the surface of the earth.

(a) 12 km   (b) 50 km   (c) 80 km   (d) 700 km   (d) 10,000 km

Answer = (e)

Mathematics used in retail advertising
A major fast-food chain held a contest to promote sales. With each purchase a customer was given a card with a whole number less than 100 on it. A $100 prize was given to any person who presented cards whose numbers totaled 100. The chain provided the following nine numbers to issue to customers on small cards. (A customer cannot use the same number twice)

    3   9   12   15   18   27   51   72   84

13. Can you find a subset of these nine numbers that total up to 100?

(a) Yes, that is easy just pick 15 and 84   (b) Yes pick 27 & 72
(c) yes pick 3, 18, 27 & 51   (d) Yes pick 3, 12, 15, 18, & 51   (d) No there is no subset of the nine numbers that add up to exactly 100

Answer = (e)

14. How many combinations are there of nine distinct numbers taken 3 at a time.

(a) 9   (b) 84   (c) 126   (d) 36   (e) none of these
Answer = (b)

15. What is the total number of combinations of nine distinct numbers taken 0 at a time, 1 at a time, 2 at a time … 3, 4, 5, 6, 7, 8 & 9 at a time.?

(a) 512   (b) 511   (c) 502   (d) 126   (e) None of these
Answer = (a)

16. Can you suggest how the contest to promote sales above can be structured so that there would be exactly 1000 winners throughout the country?

(a) Yes, allow duplication of the numbers   (b) Yes, add the number "1" to the batch of nine numbers but only provide exactly 1,000 one`s. (c) Yes, just run the contest as is with the nine numbers provided and stop the contest when you have 1,000 winners. (d) Yes, delete the number 3 from the batch of nine   (e) none of these
Answer = (b)

General Questions:

17. Why can you not divide by zero? Example 5/0 is not possible why? We define division where
    a, b, x, are real numbers and b ≠ 0 as a/b = x implies a = xb. So 5/0 is not possible since _____

(a) zero is not a real number   (b) if 5/0 = x then this means there is some real number x so that 5 = x0, oh no! 5 ≠ 0

(c) we know that 5/0 is zero   (d) 5/(very small number) = a big number clearly the answer is infinity

(e) none of these
Answer: (b)

18. How long does it take the Earth to revolve around the Sun? Answer: _____

(a) one month (b) one year   (c) one week   (d) No time the The Sun revolves around the earth   (d) None of these
Answer: (b)

19. What do you call an animal that eats both plants and animals?

(a) Carnivore (b) Herbivore (c) Omnivore (d) exovore   (e) none of these
Answer: (c)

20. What energy need to be removed from liquid water to change it to a solid? Answer: _____

(a) Heat   (b) Light   (c) Chemical   (d) electrical   (e) none of these
Answer = (a)

21. How much time must pass for a plant or animal remains t o be considered a fossil?
Answer_____

(a) 60 years   (b) 100,000 years   (c) 10,000 years   (d) one light year
        (e) none of these
Answer: = (c)

22. Which of the following actions allows electrical energy to change to another energy form. Answer: _____

(a) Sleeping in a cold room   (b) Turning a light on in a dark room (c) Cooking food on an open campfire

(d) Sleeping on a waterbed   (e) none of these
Answer: = (b)

23. What is the main purpose of a plant`s flower? Answer: _____

(a) Soak up water   (b) To produce Seeds (c) T o support the plant   (d) to allow for pollination
(d) none of these
Answer = (b)

24. What type of rock would normally form a the bottom of a river
(a) pea gravel (b) metamorphic   (c) Igneous   (d) sandstone (e) sediment tary
Answer: = (e)

25. The moon is a _____

(a) Satellite   (b) Planet   (c) Round   (d) Glowing Object   € none of these
Answer: (a)

26. We can see through easily _____ Objects

(a) Opaque   (b) translucent   (c) any   (d) transparent   (e) none of these
Answer = (d)

27. What star shines in the day and provides light. Answer = _____

(a) Moon   (b) Venus   (c) Mars   (d) The Sun   (d) none of these
Answer = (d)

28. What are the products of anaerobic respiration in yeast? Answer: _____

(a) Alcohol & Carbon Dioxide   (b) Oxygen and Alcohol   (c) carbon dioxide and glucose   (d) Glucose and Oxygen   (e) Ozone & Hydrogen
Answer: = (a)

29. Which of these diseases is not caused by improper disposal of sewage? Answer = _____

(a) Cholera   (b) Heart Attack   (c) Jaundice   (d) typhoid   (d) upset stomach
Answer: (b)

30. A merry go-round is an example of what kind of motion? Answer: _____

(a) Straight   (b) circulatory   (c) vertical   (d) Rotational (e) horizontal
Answer = (d)

31. As the frequency of a sound wave increase the wavelength _____

(a) increases   (b) decreases   (c) stays the same   (d) fluctuates   (e) none of these
Answer: (b)

32. What is the green pigment in plants that absorbs and converts sunlight into energy. Answer: _____

(a) mitochondria   (b) starch   (c) Potassium & nitrogen   (d) chlorophyll
            (d) None of these
Answer: = (d)

BOTANY AND PLANT PHYSIOLOGY

33. Championing a system already in place, which well-known scientist used binomial nomenclature to classify nearly 10,000 species?
(a) Darwin   (b) Linnaeus   (c) Watson   (d) Leopold   (e) Einstein
Answer = (b)
Carl Linnaeus was a Swedish botanist, physician, and zoologist, who laid the foundations for the modern biological naming scheme of binomial nomenclature. He is known as the father of modern taxonomy and is also considered one of the fathers of modern ecology.

34. _____ is the sum of all chemical exchanges or transformations within a living organism.
(a) Consumption   (b) Diet   (c) Digestion   (d) Metabolism   (e) endomorph
Metabolism is the set of life-sustaining chemical transformations within the cells of living organisms. These enzyme-catalyzed reactions allow organisms to grow and reproduce, maintain their structures, and respond to their environments.
Answer: = (d)

35. _____ and _____ are the conducting parts of vascular plants.

(a) Xylem, Phloem   (b) Calyx, Frond   (c) Carpel, Stamen   (d) Fruit, Flower   (d) Stigma, Sepal

Vasscular plants form a large group of plants that are defined as those land plants that have lignified tissues (the xylem) for conducting water and minerals throughout the plant. They also have a specialized non-lignified tissue (the phloem) to conduct products of photosynthesis. Vascular plants include the clubmosses, horsetails, ferns, gymnosperms (including conifers) and angiosperms (flowering plants).

Answer: = (a)

36. Which of the following is an aggregate fruit?

(a) Mulberry   (b) Strawberry   (c) Fig   (d) Apple   (e) Orange

An aggregate fruit or etaerio or etaerio is a fruit that develops from the merger of several ovaries that were separate in a single flower.

Answer: = (b)

37. The light reactions of photosynthesis occur in what part of the plant?

(a) Ribosomes   (b) Mitochondrion   (c) Nucleus   (d) Thylakoid Membranes   (e) mesomorph

In the thylakoid membranes, chlorophyll is organized along with other molecules into two photosystems (I and II). Photosystems are the light-harvesting units of the thylakoid membrane. Each photosystem has an antenna of a few hundred pigment molecules.
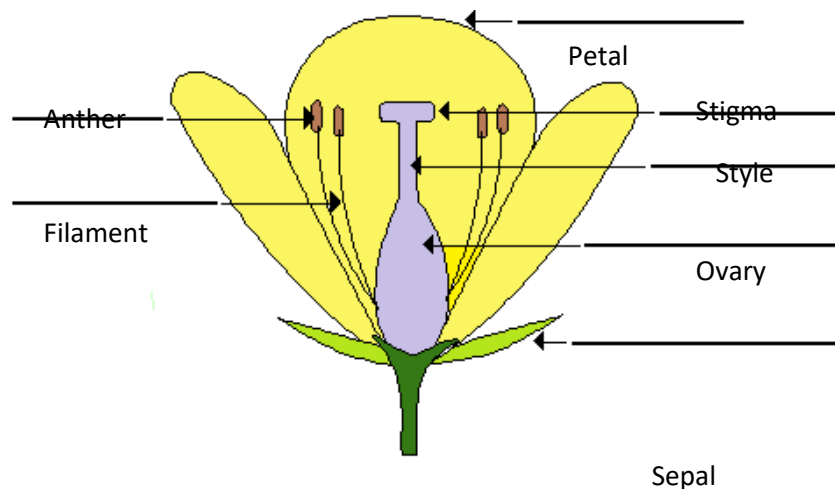
Answer = (d)

38. Which of the following is not a part of the flower:

1. Petal   2. Anther   3. Style   4. Sepal   5. Filament

(a) 1   (b) 2   (c) 3   (d) 4   (e) All five listed are parts of the flower.

Answer = (e)

39. What is the smallest unit of life?

(a) Atom   (b) Neutron   (c) Cell   (d) Virus   (e) quecto
Answer = (c)
The smallest unit of life is a cell when life is defined as the ability to replicate oneself. An argument can be made for prions and viruses to be the smallest units of life and although they are able replicate themselves, they are unable to do so without a host. I would argue that cells in an animal or plant would be unable to replicate themselves without the oxygen and nutrients that they receive by being part of an overall system.

40. Where does photosynthesis occur in plants?

                                                                2. Answer
_____
(a) Ribosome   (b) Golgi body (c) Chloroplast   (d) Endoplasmic reticulum (e) Eukaryotic
Answer = (c)
Chloroplasts are organelles found in plant cells and other eukaryotic organisms that conduct photosynthesis. Chloroplasts capture light energy to conserve free energy in the form of ATP and reduce NADP to NADPH through a complex set of processes called photosynthesis

41. The term *Protista* would be an example of which of the following

                                                                3. Answer
_____
(a) Kingdom   (b) Phylum   (c) Class   (d) Species   (e) Group
Answer = (a)
Some members of the Kingdom Protista are unicellular, some are colonial, and yet some are multicellular.

42. What is considered to be the "Solvent of Life"

                                                                4.
Answer_____
(a) Oxygen   (b) Carbon   (c) Hydrogen   (d) Water (H_2O)   (e) Helium
Answer = (d)
Water is the universal solvent for life, referred to by Nobel Laureate A. Szent-Gyorgy as "the matrix of life". The actual production of ATP in cellular respiration takes place through the process of chemiosmosis. Chemiosmosis involves the pumping of protons through special channels in the membranes of mitochondria from the inner to the outer compartment.

Bar-Code Definitions and Activities

A barcode, consist of bars & spaces, is machine-readable representation of numerals and characters. There are several types of barcodes. We introduce mainly Universal Product Code (UPC). UPC bar codes is made up of two parts. The computer reads the alternating dark-white bars given in binary code

Usually, twelve digits appear in the Arabic numeral system that one reads from a UPC. The first digit indicates type of product. (Sometimes this first digit is not in line with the others). A **"0"** in this first position indicates that the product is a <u>national brand (Standard)</u>. A "1" means reserved. **"2"** indicates

the product is a random weight items (fruits, meat, vegetables etc.) that has been weighed and wrapped within the store. A **"3"** in the first position identifies that the product as a pharmaceutical, <u>health or beauty aid</u>. A **"4"** means that the store has <u>reduced the original price</u> of the product, and a **"5"** in the first position indicates a <u>manufacturer`s cents-off coupon</u>. The last digit in the 12-character UPC is the check digit.
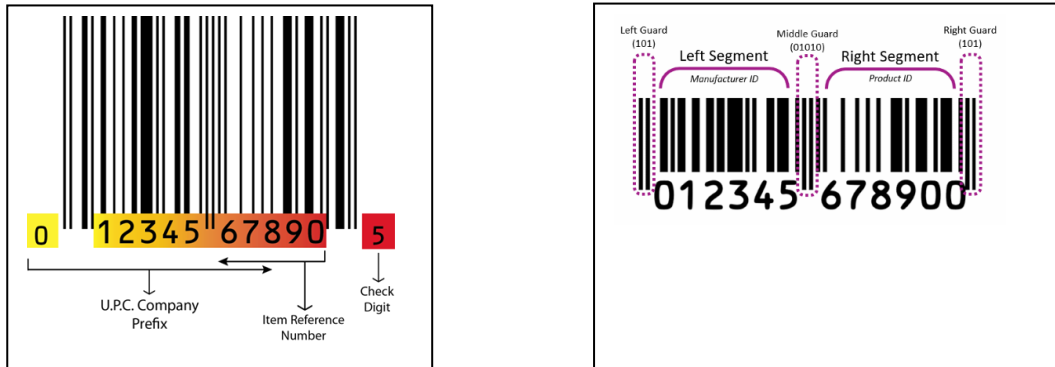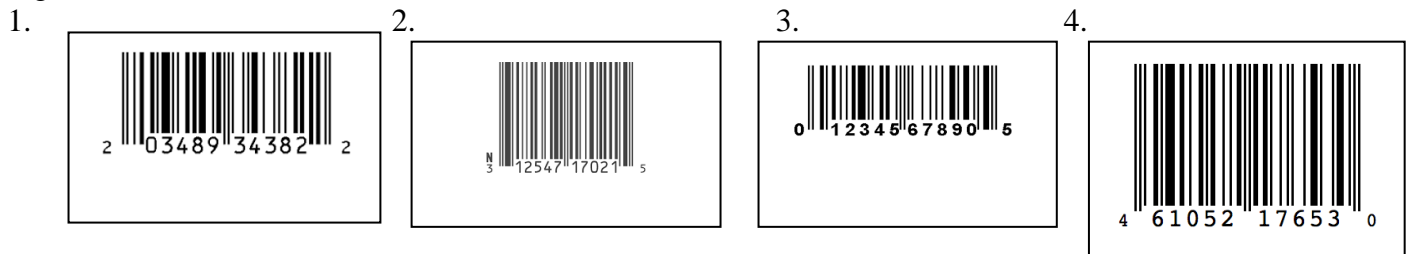
Illustrations of UPC bard code:

Figure 1

1.   2.   3.   4.

43. Which of the above bar codes represents a National Brand.

(a) 1   (b) 2   (c) 3   (d) 4   (e) none of these
Answer: (c)

After the first digit, the next five digits after the numeral showing the product type is the <u>manufacturer`s identification code number</u>. This number is assigned to the company by the Uniform Code Council in Dayton, Ohio.

44. Which of the products whose bar codes are shown in the figure (1) above are made by the <u>same company</u>? (10 Points)

(a) 1   (b) 2   (c) 3   (d) 4   (e) none of these
Answer: (e)
The second five-digit group in the UPC is <u>assigned by the company</u> itself to distinguish that particular product from all others made by the same company.   The twelfth digit in the code is the check digit. If the checkout person stores keys in the code manually and makes a mistake, such as hitting the wrong key or transposing two digits, the computer will refuse the code.

A UPC is checked by the following method.

Multiply the sum of all the digits in the odd positions of the code by 3. (Count the position the first digit occupies as position 1, and odd position). Add this product to the sum of all the digits in the even positions. (The check digit will be the last even position). If the final sum is a multiple of ten, the code is valid and will be accepted by the computer.

Example: If the bar code has these 12 digits shown here: 0 1 5 6 4 5 1 6 6 8 0 6   we get:
$3(0 + 5 + 4 + 1 + 6 + 0) + (1 + 6 + 5 + 6 + 8 + 6) = 3(16) + (32) = 48 + 32 = 80$ and 80 is a multiple of 10 so the bar code checks.

45. Check the validity of the bar codes in Bar-Code that contains the 12 digits shown to th | 2 00270 70053 6 | Points)

The final sum of is _____.

(a) The final sum is 80   (b) The final sum is 70   (c) the final sum is 69 (d) The final sum is 79   (d) The final sum is not a multiple of 10 and hence the code is invalid
Answer: (b)

Sometimes the check digit on a UPC has not been printed. The check digit on the code to the right is missing. If it is known that the bar code is valid, the check digit can be found using the same directions given above. Let C represent the check digit that is missing. Let M represent some multiple of 10 (like 10, 20, 30 etc) we have:
$3(0 + 9 + 0 + 0 + 2 + 4) + (3 + 4 + 0 + 1 + 0 + C) = M \rightarrow 3(15) + (8 + C) = M \rightarrow 45 + 8 + C = M \rightarrow 53 + C = M$
Thus C = 7 and M = 60 (note C must be one of the digits {0, 1, 2, 3, 4, 5 6, 7, 8, or 9}

46. Find the missing Check digit for the product with bar code with Arabic numerals. Find C.
                              0   8 2 6 5 7 5 0 0 6 3   C
Answer: C = _____

(a) C = 8   (b) C = 7   (c) C = 72   (d) C = 9   (d) none of these
Answer = (a)

Questions on Barcodes for E & M Contest 2023 continued

47. Which of the following listed below is not an example of a barcode.

1. Code 128   2. UPC   3. Ean-13   4. Aztec   5. OR Code

(a) 1   (b) 2   (c) 3   (d) 4   (e) All five are examples of Barcodes
Answer: (e)

48. Which of the following barcodes is used by the airlines for electronic boarding passes.

(a) Code 128   (b) UPC   (c) Data Matric   (d) Aztec   (e) OR Code
Answer: (d)

49. Standard UPC code is a _____ digit code.

(a) 10   (b) 11   (c) 12   (d) 13   (e) none of these
Answer: (c)

50. Which of the following with respect to UPC (universal Product Code) refers to the check digit.
(a) Left Guard   (b) Middle Guard   (c) Right Guard   (d) Last Digit (d) none of these
Answer: (d)

51. Which of the following is <u>not</u> a category of database registries which host UPC Product Data.
1. Global Data Synchronization Network (GDSN) & Product Catalog Services   2. Internet UPC
database   3. GTIN.Cloud   4. GS1 Tools and Registries   5. Proprietary Company
databases

52. Make a visit to a grocery store and find the following item:
                          Jif Creamy Peanut, NET WT 454 g
What is the first and last digit for UPC product code for this item:

(a) 0 & 4   (b) 3 & 2   (c) 8 and 5   (d) 0 & 2   (d) none of these
Answer: (d)

True False questions:

53. All barcodes each have 12 digits.
(a) True   (b) False
Answer: (b) False
54. The last digit in a 12-digit barcode is the check digit.
(a) True   (b) False
Answer: (a) True

55. All UPC barcodes have a left quiet zone but not a right quiet zone.
(a) True   (b) False
Answer = (b) False
56. The white space at the beginning of a 12-digit barcode is referred to as the quite zone.
(a) True   (b) False
Answer: (a) True

57. Universal Product Codes (UPC) do not have a country code where EAN-13 does.
(a) True   (b) False
Answer: (a) True

New Metric Prefixes

The ability to better describe ultra large quantities and ultra small quantities was implemented in
November of 2022 at the 27th meeting of the General Conference on Weights and Measures near Paris
France. The new prefixes are **<u>ronna</u>**, **<u>quetta</u>**, **<u>ronto</u>**, and **<u>quecto</u>**. Ronna is a 1 following by 27 zeros;
ronto is sort of the inverse of Ronna 0.0 …(27 zeros) with the very last digit a 1. Quetta is a 1
followed by 30 zeros, and quecto sort of the inverse of Quetta. Quecto is 0.0… (30 zeros) with the last
digit a 1.

58. One rontogram is equal to _____ yoctograms.
(a) 0.01 yoctograms   (b) 0.000 1 yoctograms   (c) 27 yoctograms   (d) 0.001 yoctograms
       (e) 10^{-24} yoctograms.
Answer: = (d)

59. The earth has a mass of about 6,000 yottagrams. 6,000 yottagrams would be equivalent to _____ Ronnagrams.
(a) 0.1 Ronnagrams   (b) 6 Ronnagrams   (c) 0.001 Ronnagrams   (d) 60 Ronnagrams   (d) none of these
Answer = (b)

60. Which of the following metric prefixes was not implemented at the meeting of Genera Conference on Weights and Measures in France November of 2022.

1. **ronna (R)**   2. **quetta (Q)**,   3. **ronto (r)**,   4. **quecto (q)**   **5. Yotta (Y)**

(a) 5   (b) 4   (c) 3   (d) 2   (d) 1
Answer: (a)

Please let us know what grade level you are in at your school. I am in grade level _____

(a) 4th   (b) 5th   (c) 6th   (d) 7th   (e) 8th   (f) other

Stop
Each Question counts 5 points: