

GENERAL SCIENCE PAPER I (PART 'A')

1. If the speed of light (3×10^8 m/s) and the mean radius of the earth (6×10^3 km) are taken to be the units of speed and length respectively, then the value of the new unit of acceleration expressed in m/s^2 will be

1. 1.5×10^{10}
2. 50
3. 0.02
4. 1.2×10^5

2. The minimum number of multiplications required to evaluate the expression $a + bx + cx^2 + dx^3 + ex^4$ is

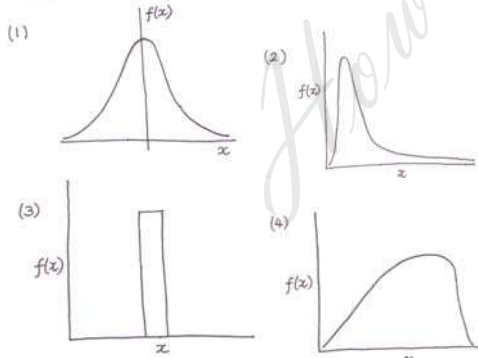
1. 4
2. 5
3. 3
4. 7

3. Consider the function

$$f(x) = x(1-x) \text{ for } 0 \leq x \leq 1$$

The function

1. attains minima at $x = \frac{1}{2}$ and $\frac{3}{4}$.
 2. is discontinuous in the given interval
 3. is negative at a few points in the given interval.
 4. has a maximum at $x = \frac{1}{2}$.
4. Which of the following distributions has the smallest variance?

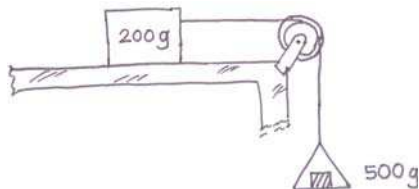


5. One way to determine whether a number (n) is prime or not is to divide it by numbers less than itself. The number of divisions required is

1. $n/2$
2. $n-1$
3. $2\sqrt{n}$
4. less than \sqrt{n}

6. The angular velocity vector of the Earth's rotation points
1. from east to west
 2. from west to east
 3. from north to south
 4. from south to north
7. The top of a mountain is at an elevation of 45° from one bank of a river and at an elevation of 60° from the other bank. If the river has a width of 1 km, what is the height [in km] of the mountain?
1. $\frac{1}{2}$
 2. $\sqrt{3}$
 3. $\frac{\sqrt{3}}{1+\sqrt{3}}$
 4. $\frac{\sqrt{3}}{\sqrt{3}-1}$
8. On a cold day, a copper vessel feels colder to touch than a glass bowl. What is the reason for this?
1. Glass does not cool down as easily as copper does.
 2. Glass is a poor conductor of heat compared to copper.
 3. The specific heat of glass is higher than that of copper.
 4. Glass radiates more heat than copper does.
9. If the distance between two bodies of masses m_1 and m_2 is doubled, the gravitational force between them
1. doubles.
 2. halves.
 3. becomes one-fourth.
 4. remains the same.
10. A cricket ball and a football are dropped simultaneously from the top of Qutub Minar. Which of the following best describes their subsequent behaviour?
1. They touch the ground at the same instant.
 2. They touch the ground with the same velocity.
 3. The cricket ball reaches before the football.
 4. The football reaches before the cricket ball.

11. A mass m (200 g) slides horizontally due to a downward force applied by a 500 g weight (as shown in figure). The velocity of the mass m (ignoring friction)
- 12.

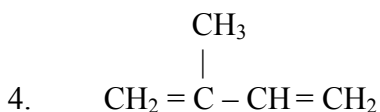
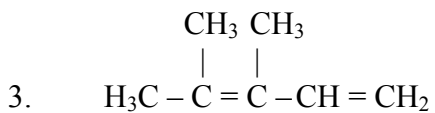
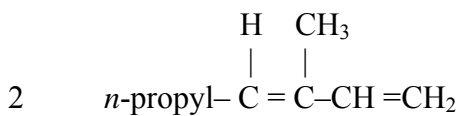
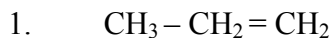


1. increases as a function of time with constant acceleration.
 2. remains constant.
 3. changes with time with increasing acceleration.
 4. changes with time with decreasing acceleration.
12. The O–H bonds in water molecule are polar. The molecule is symmetric and the H–O–H bond angle is approximately 107° . The dipole moment vector of the molecule is
1. zero
 2. along the OH bond
 3. randomly oriented
 4. along the bisector of the H–O–H angle
13. You wish to observe a small organism closely, using a convex lens. If you wish to avoid distortion of the image, you should keep the object
1. at a distance greater than the focal length
 2. less than the focal length
 3. at twice the focal length
 4. exactly at the focal length
14. A charged particle moving with a constant velocity enters a magnetic field perpendicular to its velocity. In which direction y an electric field should be applied to compensate the magnetic force?
1. Along the initial velocity
 2. Perpendicular to the initial velocity and parallel to the magnetic field
 3. Perpendicular to both, the initial velocity and the magnetic field
 4. Along the magnetic field
15. Two pendula of lengths l_1 and $l_2 (= 2l_1)$ have the same period at two different locations. The accelerations due to gravity at these two locations, g_1 and g_2 , are related by
1. $g_1 = g_2$
 2. $g_1 = 2g_2$
 3. $g_2 = 2g_1$
 4. $g_2 = 4g_1$

16. Water rises naturally out of an artesian well because
1. the water has lots of dissolved gases
 2. the water table is at the ground level
 3. the water table is below the ground level
 4. the water table is above the ground level
17. Although, we know from chemical evidence that life on Earth evolved as early as 3.5 billion years ago, the most ancient available fossils are only 0.54 billion years old. This is because
1. acidic ocean dissolved all life forms
 2. early life forms were soft bodied
 3. rocks older than 0.54 billion years do not exist
 4. a large asteroid impact destroyed all earlier records
18. During α -decay of a radioactive atom, the mass number reduces by 4 units and the atomic number decreases by 2 units. How many α -particles will be generated during the decay of a ${}_{92}^{238}\text{U}$ atom to a ${}_{82}^{206}\text{Pb}$ atom.
1. 8
 2. 16
 3. 10
 4. 5
19. Depletion of ozone layer and formation of ozone hole in polar regions is a phenomenon occurring in the
1. troposphere.
 2. mesosphere.
 3. stratosphere.
 4. thermosphere.
20. Sea levels are predicted to rise in the near future mainly due to
1. sinking of landmass
 2. increased rainfall
 3. gravitational pull of the moon
 4. melting of glaciers.
21. The pH value of distilled water is always below 7. This is because
1. distillation reduces the ionic product of water.
 2. during distillation inorganic salts are removed.
 3. nitrogen from air gets dissolved in it.
 4. CO_2 from air dissolves in it.

22. Photosynthesis in water bodies is restricted to a certain depth. This is mainly because
1. temperature decreases with depth
 2. light intensity decreases with depth
 3. dissolved CO_2 is available only to a certain depth
 4. nutrients are available only to a certain depth
23. The velocity of P (pressure) and S (shear) seismic waves depends on the compressibility, shear modulus and density of the medium. The inner core of the Earth is inferred to be liquid using seismic wave travel time. This is because
1. the density of the inner core is the highest.
 2. the inner core has a very high compressibility.
 3. both P and S waves pass through the inner core.
 4. the S wave does not pass through the inner core.
24. One of the following chemicals used as food preservative is
1. sodium benzoate
 2. sodium alkylbenzene sulfonate
 3. ethylene glycol
 4. aspartic acid
25. Qualitative analysis of Al^{3+} in presence of Fe^{3+} and Cr^{3+} is based on
1. reducing nature of Fe^{3+}
 2. oxidizing nature of Cr^{3+}
 3. amphoteric nature of Fe^{3+}
 4. amphoteric nature of Al^{3+} and Cr^{3+}
26. Hydrolysis of t -butyl chloride in presence of aqueous alkali produces t -butyl alcohol. The rate of hydrolysis depends on
1. concentration of t -butyl chloride
 2. concentration of alkali
 3. amount of water
 4. concentration of both alkali and t -butyl chloride

27. Which one of the following would give natural rubber upon polymerisation?



28. The ionization potential (IP) of hydrogen atom is 13.6 eV. The estimated second IP of the helium atom (in eV) is

1. 6.8
2. 27.2
3. 54.4
4. 13.6

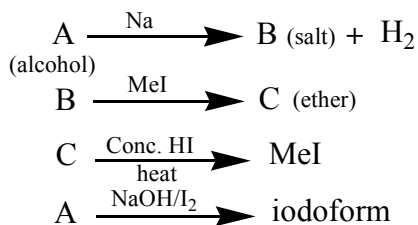
29. The following molecule has a non-zero dipole moment

1. CH_4
2. CO_2
3. NH_3
4. BF_3

30. The oxidation number of Cr in CrO_5 is

1. +6
2. +3
3. +10
4. +5

31.



The alcohol (A), salt (B) and ether (C), are respectively

1. CH_3OH , CH_3ONa , $\text{CH}_3\text{-O-CH}_3$
 2. CH_3OH , $\text{C}_2\text{H}_5\text{ONa}$, $\text{CH}_3\text{-O-C}_2\text{H}_5$
 3. $\text{C}_2\text{H}_5\text{OH}$, $\text{C}_2\text{H}_5\text{ONa}$, $\text{C}_2\text{H}_5\text{-O-C}_2\text{H}_5$
 4. $\text{C}_2\text{H}_5\text{OH}$, $\text{C}_2\text{H}_5\text{ONa}$, $\text{CH}_3\text{-O-C}_2\text{H}_5$
32. In any ecosystem, the primary producers such as photosynthetic plants are the most abundant and predators such as tigers are the least abundant. The fundamental law responsible for this pattern is
1. first law of thermodynamics
 2. second law of thermodynamics
 3. Mendel's laws of genetics
 4. law of conservation of mass
33. In the Siberian forests, carbon fixation is expected to be maximum in
1. January
 2. July
 3. October
 4. April
34. Movement of water in a tree takes place in
1. roots only
 2. in the central part of the stem
 3. in the peripheral part of the stem
 4. leaves only
35. Which of the following is **not** used as a fertilizer?
1. Ammonium nitrate
 2. Ammonium phosphate
 3. Urea
 4. Sodium chloride

36. In DNA, Adenosine pairs with Thymine, and Guanine pairs with Cytosine. If Adenosine constitutes 18% and Guanine constitutes 24% of all nucleotides in a DNA preparation, it must be a
1. single stranded DNA
 2. double stranded DNA
 3. very short stretch of double stranded DNA
 4. multi-chromosomal DNA
37. A bacterium which is $1\ \mu$ in diameter and divides every 20 minutes, forms a 1 mm diameter colony in 24 hours in a growth medium with limited nutrients. The number of cells in the colony is approximately
1. 1000
 2. 10^9
 3. 2×72
 4. 2^{72}
38. Burns caused by steam are more serious than burns caused by boiling water because
1. steam has large latent heat
 2. steam has a very large specific heat compared to water
 3. steam is hotter than boiling water
 4. steam being a gas makes easy contact with skin
39. The largest decimal number that a four byte integer can represent is approximately
1. 10^5
 2. 10^7
 3. 10^9
 4. 10^{11}
40. A modern personal computer is capable of multiplying two numbers in a few
1. picoseconds
 2. nanoseconds
 3. microseconds
 4. milliseconds