

## Instruction

All questions are compulsory.

There are five major sections in this paper - English, Mathematics, Physics, Chemistry and IQ. There is no negative marking.

The marks wise distribution of each of the section is as follows

Section	Subject	Marks	Time [Suggested ]
A	English	8 + 6 + 6	30 Minutes
B	Mathematics	20	45 Minutes
C	Physics	20	30 Minutes
D	Chemistry	20	30 Minutes
E	IQ	10	15 Minutes

You are advised to spend the suggested time.

Please darken the most appropriate answer in the provided answer sheet.

Special Note: The highest score obtained in either Physics or Chemistry will be considered for the evaluation.

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### Section A: English

#### **New World colonist's No. 1 enemy: Droughts**

##### **[Paragraph 1]**

Two of the most ferocious droughts of the millennium may have triggered the mass starvation at America's first English settlement at Jamestown and also sealed the fate of the 120 inhabitants of the "Lost Colony" on Roanoke Island, whose disappearance 20 years earlier remains one of the most enduring mysteries of the colonial period.

##### **[Paragraph 2]**

New research reported Thursday appears to confirm the existence of the back-to-back famines, shedding new light on the extraordinary hardships faced by early colonists as they struggled to gain a foothold in the New World.

##### **[Paragraph 3]**

"It wasn't just a drought, it was an amazing drought," said Dennis Blanton, director of the Center for Archaeological Research at the College of William and Mary, who used tree rings to reconstruct weather patterns in the tidewater region of Virginia and North Carolina dating back nearly 1,000 years.

##### **[Paragraph 4]**

In a case of monumentally bad timing, both the Jamestown colony and the ill-fated earlier settlement at Roanoke, off the North Carolina coast, were founded precisely as epic dry spells were parching large swaths of the Southeast, according to the report in Friday's edition of the journal Science.

##### **[Paragraph 5]**

Rainfall data gleaned from ancient cypress trees shows that the region's worst three-year drought in 800 years peaked in 1587, the year the 120 men, women and children of the Roanoke colony were last seen by Europeans. Sir Walter Raleigh, the founder of North

America's aborted first English settlement, left his fellow colonists behind that year to sail to England for fresh supplies. His return three years later found no trace of the settlers, including young Virginia Dare, the first English child born in the New World. The sole, tantalizing clue about their whereabouts was a single word, "Croatoan," which was found carved into a tree near the abandoned fort.

**[Paragraph 6]**

Historians have long debated what became of the colonists, but the discovery of the previously unknown drought presents a new set of possibilities, Blanton said. Perhaps famine forced them to seek refuge with the Croatoan Indians, one of the indigenous tribes.

STUDY/Drought may have killed colonists

**[Paragraph 7]**

"We're introducing drought as a significant factor that people have to consider," he said. "We're still not in a position to explain the mystery of the famous disappearance, but we may know more about the situation that led to it."

**[Paragraph 8]**

The tree-ring data also may help explain the dire conditions at Jamestown 20 years later, when nearly half of the 350 colonists alive in June 1610 died by the end of the summer. The period from 1609 to 1610 is known historically as "the starving time," a calamity that Blanton says that appears likely to have been caused by a prolonged famine. The dry spell lasted from 1606, the year before Jamestown was founded, until 1612, and ranks as the worst seven-year drought in 770 years, the report says.

**[Paragraph 9]**

The scant historical record from the time refers to shortages of food and potable water in the colony. Jamestown's most famous resident, Capt. John Smith, wrote of local Indians refusing to share food with the struggling colonists because of concerns about their own food supply. But until now there was little direct evidence of the profoundly grim conditions facing both the colonists and the Powhatan Indians who initially aided the settlers.

**[Paragraph 10]**

"The Roanoke and Jamestown colonies have both been criticized for poor planning, poor support, and for a startling indifference to their own subsistence," wrote Blanton and co-author David Stahle, a University of Arkansas climatologist, in their report. "But tree-ring reconstruction indicates that even the best planned and supported colony would have been supremely challenged by the climactic conditions."

**[Paragraph 11]**

Scientists have only recently begun to appreciate the rich trove of environmental and climatological information contained in the bald cypress trees native to the Tidewater region. The trees are not only long-lived but they also contain an unusually sharp climate map in the fluctuating patterns of growth rings on their trunks. The record studied by Blanton and Stahle covers a period nearly 1,000 years. The scientists found corroboration for their findings in recent meteorological data as well as circumstantial evidence in the historical record.

1. What is the main idea of the article?

- A. Droughts killed the colonists in Jamestown and Roanoke.
- B. Climatologists have learned how to study trees to understand droughts.
- C. Dry weather might have made it difficult for the first colonists to survive.
- D. Scientists have discovered why the Jamestown and Roanoke colonies did not survive.

E. There was a drought

2. The rings of bald cypress trees are informative because

- A. the trees grow for a long time.
- B. the trees grow better during drought.
- C. the tree had "Croatoan" carved into it.
- D. the tree is the only tree that grew in the area.
- E. these trees provide information

3. Read this sentence from the article.

"Rainfall data gleaned from ancient cypress trees shows that the region's worst three-year drought in 800 years peaked in 1587, the year the 120 men, women and children of the Roanoke colony were last seen by Europeans."

What does peaked mean?

- A. was sharp
- B. was at its height
- C. was in a mountainous area
- D. was at the top of the rainfall charts
- E. was next to a mountain peak

4. Who was the best known member of the Jamestown colony?

- A. John Smith
- B. David Stahle
- C. Walter Raleigh
- D. Dennis Blanton
- E. Scott Parker

5. Which statement from the article best supports the idea that severe droughts occurred about 400 years ago?

- A. "The record studied by Blanton and Stahle covers a period of nearly 1,000 years."
- B. "The discovery of the previously unknown drought presents a new set of possibilities."
- C. "Rainfall data gleaned from ancient cypress trees shows the region's worst three-year drought in 800 years peaked in 1587."
- D. "We're still not in a position to explain the mystery of the famous disappearance, but we may know more about the situation that led to it." The author includes information about Jamestown and Roanoke in the article because both colonies.
- E. "There was chance of a rain"

6. The author includes information about Jamestown and Roanoke in the article because both colonies

- A. disappeared without a trace.
- B. were located in New England.
- C. were famous places in U.S. history.
- D. suffered difficulties as they tried to survive
- E. came into existence at the same time

7. This article would be most useful for a report on

- A. the life of Sir Walter Raleigh.
- B. the role weather plays in history.
- C. why people should conserve water.
- D. how trees helped people settle North America.
- E. the history of weather

8. (\_\_\_\_) : QUARREL :: SKIRMISH : BATTLE

- A. war
- B. tiff
- C. fiasco
- D. rendezvous
- E. guns

9. (\_\_\_\_) : SURPASSED :: INDISPUTABLE : CHALLENGED

- A. grandiose
- B. peerless
- C. opaque
- D. lavish
- E. transparent

10. ACROBAT : (\_\_\_\_) :: SURGEON : DEXTROUS

- A. nuanced
- B. circumspect
- C. lithe
- D. bombastic
- E. jump

11. (\_\_\_\_) : BODY :: RATIONAL : MIND

- A. sartorial
- B. macroscopic
- C. corporeal
- D. fetal
- E. absent

12. (\_\_\_\_) : CAUSE :: SECTARIAN : SECT

- A. skeptic
- B. pariah
- C. maverick
- D. partisan
- E. introvert

13. STANCH : FLOW :: (\_\_\_\_) : OSCILLATION

- A. corroborate
- B. whet
- C. validate
- D. damp
- E. vibrate

14. Select a word which is antonym of the word "Revere"?

- A. Accept
- B. Convert
- C. Accelerate
- D. Consider
- E. Vilify

15. Select a word which is most opposite in meaning to the word "diversification".

- A. Assortment
- B. Change
- C. Variousness
- D. Concentration

E. Change

16. A businessman must widen his horizons; a \_\_\_\_ attitude will get you nowhere in this age of global communications.
- A. moderate
  - B. petrified
  - C. parochial
  - D. diversified
  - E. comprehensive
17. Dr. Stuart needs to \_\_\_\_ his argument with more experimental data; as it stands his thesis is \_\_\_\_.
- A. support - profound
  - B. bolster - acceptable
  - C. refine - satisfactory
  - D. buttress - inadequate
  - E. define - succinct
18. After an initially warm reception by most reviewers and continued \_\_\_\_ by conservative thinkers, Bloom's work came under heavy fire.
- A. criticism
  - B. endorsement
  - C. denigration
  - D. counterattack
  - E. refutation
19. Through the 19th Century, the classics of Western Civilization were considered to be the \_\_\_\_ of wisdom and culture, and an \_\_\_\_ person - by definition- knew them well.
- A. foundation - average
  - B. epitome - uneducated
  - C. cornerstone - obtuse
  - D. font - ecclesiastical
  - E. repository - educated
20. All European countries are seeking to diminish the check upon individual \_\_\_\_ which state examinations with their \_\_\_\_ growth have brought in their train.
- A. rights - liberating
  - B. liberties - empowering
  - C. spontaneity - tyrannous
  - D. foibles - inevitable
  - E. creativity - soporific

### Section B: Mathematics

21. If  $y = x^x$ ,  $x > 0$  then  $\frac{dy}{dx}$
- A.  $\log x$
  - B.  $2 + \log x$
  - C.  $x^x \log x$
  - D.  $x^x (1 + \log x)$
22. The value of integral  $\int_{-a}^a f(x)dx$  is equal to:
- A. 0 if  $f(x)$  is an even function
  - B.  $2\int_0^a f(x)dx$  if an odd function

- C.  $2\int_0^a f(x)dx$  if an even function  
D. 0 if  $f(x)$  is an odd function

23. Does  $f(c) = (c + 2)^3 - 2$  have an inflection point? If so, where is it located?

- A. Yes, at  $(-2, -2)$   
B. Yes, at  $(2, -2)$   
C. Yes, at  $(8, -2)$   
D. No

24. if  $f(x) = 3x+5$   $g(x) = 2x^2$  then,  $fg(x) =$

- A.  $6x^2 + 3$   
B.  $9x^2 + 30x + 25$   
C.  $18x^2 + 60x + 50$   
D.  $18x^2 + 30x + 50$

25. The derivative of  $3x^2$  is

- A. 6  
B.  $3x$   
C.  $6x+1$   
D.  $6x$

26. The differential coefficient of  $\sin x$  w.r.t  $\log x$  is

- A.  $\cos x/x$   
B.  $\sin x/x$   
C.  $x \cos x$   
D.  $x \sin x$

27. The area of triangle formed by the intersection of the line  $x+y-4 = 0$ , x-axis and y-axis is:

- A. 4 square units.  
B. 16 square units  
C. 8 square units.  
D. None of the above.

28. The equation of straight line passing through origin and the intersection of  $x + 2y + 3 = 0$  and  $2x + y + 1 = 0$  is:

- A.  $x + 5y = 0$   
B.  $5x + y = 0$   
C.  $5x + y + 1 = 0$   
D.  $x + 5y + 1 = 0$

29. If  $x^2 + y^2 - 2x - y + k = 0$  represents a point circle then the value of  $k$  is:

- A. 54  
B. 0  
C. - 54  
D. 14

30. The nature of the roots of  $2x^2 - 3x - 2 = 0$  is

- A. Real  
B. Rational  
C. Unequal  
D. All of above

31. The ratio in which the line  $3x - y + 5 = 0$  divides the line segment joining the points  $(2, 5)$  and  $(-2, 2)$  is :

- A. 1:2
- B. 2:1
- C. 3:2
- D. 1:3

32. The slope of the line  $x\cos\alpha + y\sin\alpha = p$  is

- A.  $-\cot\alpha$
- B.  $\sin\alpha$
- C.  $-\tan\alpha$
- D.  $\tan\alpha$

33. The value of  $K$  such that  $Kx^2 - 8xy + y^2 = 0$  are coincident lines if

- A.  $K=32$
- B.  $K=-1$
- C.  $K=16$
- D.  $K=2$

34. If the lines  $ax+2y+1=0$ ,  $bx+3y+1=0$  and  $cx+4y+1=0$  are concurrent then  $a, b, c$  are in:

- A. A.P
- B. G.P
- C. H.P
- D. Arithemico-geometric progression

35. What is the probability that an English alphabet selected at random is a vowel?

- A. 2126
- B. 1526
- C. 526
- D. 326

36. Which of the following is dependent on change of scale but independent of change of origin?

- A. Mean
- B. Median
- C. Standard deviation
- D. Mean deviation

37. Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn has a number which is a multiple of 3 or 5?

- A.  $\frac{2}{5}$
- B.  $\frac{8}{15}$
- C.  $\frac{1}{2}$
- D.  $\frac{9}{20}$

38. If two random variables  $X$  and  $Y$  are independent,

- A. their joint distribution equals the product of their marginal distributions
- B. the conditional distribution of  $X$  given  $Y$  equals the marginal distribution of  $X$
- C. their covariance is zero
- D. all of above

39. In how many ways can 10 students and teacher be seated in a circular table in a class?

- A. 11! Way
- B. 10! Way
- C. 100 ways

D. 9! Way

40. If A and B are independent event with  $P(A) = 2/3$  and  $P(B) = 3/5$ , then  $P(A \cup B) =$
- A. 13/15
  - B. 2/5
  - C. 19/15
  - D. 1/15

### Section C: Physics

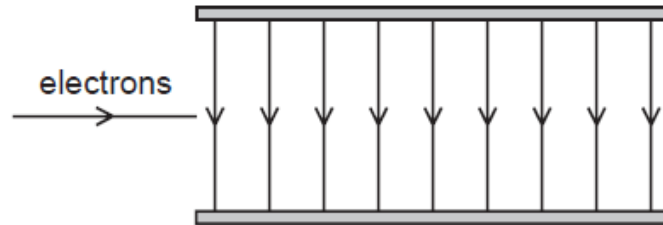
41. In a semiconductor, the forbidden energy gap between valance band and conduction band is in the order of:
- A. 5eV
  - B. 1eV
  - C. 1MeV
  - D. 1keV
42. The p-type semiconductor is:
- A. Positively charged
  - B. Negatively charged
  - C. Uncharged
  - D. None of the above
43. The antiparticle of an electron is:
- A. Positron
  - B. Proton
  - C. Alpha partial
  - D. Beta partial
44. If R is the maximum horizontal range of a projectile, the corresponding greatest height is equal to:
- A. 4R
  - B. 2R
  - C. R/2
  - D. R/4
45. A person walks first 10 km north and 20 km east, the resultant vector is
- A. 22.36 km
  - B. 22.46 km
  - C. 25.25 km
  - D. 20.36 km
46. Swimming is possible by the
- A. First law of motion
  - B. Second law of motion
  - C. Third law of motion
  - D. None of the above
47. Which defines the weight of a body?
- A. The amount of matter in the body
  - B. The force of gravity on the body
  - C. The number of particles in the body
  - D. The product of body's volume and density



48. Which physical quantity would result from a calculation in which a potential difference is multiplied by an electric charge?

- A. Electric current
- B. Electric energy
- C. Electric field strength
- D. Electric power

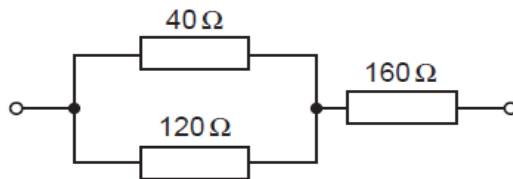
49. Electrons are accelerated and then directed into the uniform electric field between two parallel plates in a vacuum.



What best describes the shape of the path followed by the electrons in the field?

- A. a downwards curve along a line that is part of a circle
- B. a downwards curve along a line that is not part of a circle
- C. an upwards curve along a line that is part of a circle
- D. an upwards curve along a line that is not part of a circle

50. The diagram shows part of a circuit.



What is the total resistance of the combination of the three resistors?

- A.  $320\ \Omega$
- B.  $240\ \Omega$
- C.  $190\ \Omega$
- D.  $80\ \Omega$

51. The velocity of sound in air at  $20^\circ\text{C}$  is  $340\text{m/s}$ . What will be it when pressure of the gas is doubled and the temperature is raised by  $20^\circ\text{C}$ ?

- A.  $340\ \text{m/s}$
- B.  $351\ \text{m/s}$
- C.  $352\ \text{m/s}$
- D.  $363.20\ \text{m/s}$

52. Ashmita throws a water balloon vertically downward from the top of a building. The balloon leaves Ashmita's hand with a speed of  $6\text{m/s}$ . Air resistance may be ignored, so the water balloon is in free fall after it leaves Ashmita's hand. What is its speed after falling for  $2.00\text{s}$ ?

- A.  $25.5\ \text{m/s}$
- B.  $15.2\ \text{m/s}$
- C.  $31.6\ \text{m/s}$
- D.  $28.9\ \text{m/s}$

53. An iron ball is heated. The percentage increase will be largest in

- A. Diameter
- B. Surface area

- C. Volume
- D. Density

54. The depth of water of surface tension  $72 \times 10^{-3}$  N/m at which air bubble of radius 0.4mm remain in equilibrium is
- A. 7.4 cm
  - B. 0.92 cm
  - C. 1.84 cm
  - D. 3.6 cm
55. When the temperature of metallic conductor is increased its resistance
- A. Always decreases
  - B. Always increases
  - C. May increase or decreases
  - D. Remains the same
56. A tap can supply water at 10oc and another tap at 100oc. the mass of hot water mixed with cold water so that 20 kg water at 35oc is obtained.
- A. 1.2 kg
  - B. 3.5 kg
  - C. 5.5 Kg
  - D. 3.8 kg
57. Conversion of A.C into D.C is done by
- A. Diodes
  - B. Filter Circuit
  - C. Rectifier
  - D. Transistor
58. Zener diode is used for
- A. Rectification
  - B. Amplification
  - C. Stabilization of Voltage
  - D. Defector
59. Twinkling of star is due to
- A. Reflection
  - B. Refraction
  - C. Interference
  - D. Dispersion
60. The deflection in a moving coil galvanometer is reduced to half, when it is shunted with a  $40 \Omega$  coil. The resistance of the galvanometer is:
- A.  $10 \Omega$
  - B.  $20 \Omega$
  - C.  $40 \Omega$
  - D.  $80 \Omega$

#### Section D: Chemistry

61. Normality of 2 M sulphuric acid
- A. 2 N
  - B. 4 N
  - C. N2
  - D. N4

62. Hydrogen bond is strongest in
- A. Water
  - B. Ammonia
  - C. Hydrogen fluoride
  - D. Acetic acid
63. Electrochemical equivalent refers to mass deposited in which of the following cases:
- A. 1 Faraday
  - B. 1 Coulomb
  - C. 1 A current
  - D. 96500 C charge
64. The heat of neutralization of a strong acid and a strong alkali is  $57.0 \text{ KJ mole}^{-1}$ . The heat released when 0.3 mole of  $\text{HNO}_3$  solution is mixed with 0.1 mole of KOH in dilute aqueous solution is
- A. 57.0 KJ
  - B. 5.7 KJ
  - C. 17.1 KJ
  - D. 22.8 KJ
65. Oxidation state of O-atom in Potassium superoxide is
- A. Zero
  - B.  $-(1/2)$
  - C. -1
  - D. -2
66. Which is the best reducing agent?
- A.  $\text{F}^-$
  - B.  $\text{Cl}^-$
  - C.  $\text{Br}^-$
  - D.  $\text{I}^-$
67. 100 ml of 1M HCl is mixed with 75 ml of 1 M  $\text{Na}_2\text{CO}_3$ . The resulting solution will be:
- A. Acidic
  - B. Basic
  - C. Amphoteric
  - D. Neutral
68. Which of the following have the highest pH with water?
- A. NaCl
  - B.  $\text{Na}_2\text{CO}_3$
  - C. KCl
  - D.  $\text{NaHCO}_3$
69. The equivalent weight of bicarbonate ion is:
- A. 31.75
  - B. 49
  - C. 61
  - D. 98
70. The oxidation number of Fe in the compound  $\text{K}_4[\text{Fe}(\text{CN})_6]$  is:
- A. +3

- B. -3
- C. +2
- D. -2

71. A hydrated salt when exposed to air loses water, it is called

- A. Efflorescent
- B. Deliquescent
- C. Hygroscopic
- D. None

72. 75% of the first order reaction was completed in 32 minutes. When was 50% of the reaction completed?

- A. 12 minutes
- B. 16 minutes
- C. 21 minutes 20 seconds
- D. 24 minutes

73. A zero order reaction is one:

- A. in which reactants do not react
- B. whose rate increases with time
- C. whose rate decreases with time
- D. whose rate does not change with time

74. The ratio of RMS speed to average speed of gas molecule at a particular temperature is.

- A. 1.086:1
- B. 1:1.086
- C. 2:1.086
- D. 1.086:2

75. According to Hess's Law the change in enthalpy in chemical reaction depends on the.

- A. Intermediate State
- B. Initial State
- C. Initial and Final State
- D. Final State

76. An atom of an element contains 13 electrons. Its nucleus has 14 neutrons. The mass number of element is

- A. 14
- B. 13
- C. 27
- D. 44

77. The equivalent mass of  $\text{KMnO}_4$  in acidic medium is

- A.  $M/2$
- B.  $M/3$
- C.  $M/4$
- D.  $M/5$

78. Aqueous solution of  $\text{FeCl}_3$  is

- A. Acidic
- B. Basic
- C. Amphoteric
- D. Neutral

79. Copper, Silver and gold are called

- A. Alkali metals
- B. Alkaline metals
- C. Coinage metals
- D. Active metals

80. Cinnabar is the ore of:

- A. Copper
- B. Mercury
- C. Lead
- D. Zinc

Section E: IQ

81. Please enter the missing figure: 4, 5, 8, 17, 44,

- A. 80
- B. 125
- C. 112
- D. 60

82. Please enter the missing figure: 13, 57, 911, 1315, 1719

- A. 2123
- B. 1879
- C. 3002
- D. 5004

83. 29, 27, 24, 20, 15.....what is next?

- A. 9
- B. 7
- C. 10
- D. 11

84. Which number should come next in this series? 25, 24, 22, 19, 15

- A. 4
- B. 5
- C. 10
- D. 14

85. Which number should come next in this series? 3, 5, 8, 13, 21,

- A. 4
- B. 21
- C. 31
- D. 34

86. At the end of a banquet 10 people shake hands with each other. How many handshakes will there be in total?

- A. 100
- B. 20
- C. 45
- D. 50

87. The day before the day before yesterday is three days after Saturday. What day is it today?

- A. Monday

- B. Tuesday
- C. Wednesday
- D. Thursday

88. Select the number that best completes the analogy  $10 : 6 :: 3 : ?$

- A. 2
- B. 1
- C. -1
- D. 12

89. Which number should come next in the series 1, 3, 6, 10, 15,

- E. 8
- F. 11
- C. 24
- D. 21

90. 165135 is to peace as 1215225 is to

- A. lead
- B. love
- C. loop
- D. castle