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Applicant's Name: _____

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Test Centre: _____

	Section Title	Question Type	No. of Questions	Question Nos.	Total Time *
Part I	1. English Language	Multiple choice	18	1 – 18	2 hours (10.30 a.m. to 12.30 p.m.)
	2. Quantitative Reasoning	Multiple choice	15	19 - 33	
Part II	Descriptive component (Answer the question corresponding to your first major of preference)	Subjective			1 hour (12.30 p.m. to 1.30 p.m.)

* Candidates shall be allowed to leave the examination hall only after 1 hour of the commencement of the Examination.

Please read the following instructions carefully:

1) At the test venue, the instructions given by the test administrator and invigilators must be followed. Violation of instructions will result in disqualification and the candidate will be asked to leave the examination hall. Any candidate found guilty of using unfair means of any nature in the examination hall shall be liable to be disqualified.

2) Candidates are not allowed to carry any papers, notes, books, log table, calculators or calculating devices, scanning devices, communication devices like cellular phone/pager/docupen, etc. to the Examination Hall.

3) Please use ONLY blue/black ball point pen to fill details and to darken the circles on the OMR sheet. **USING PENCILS IS PROHIBITED.**

4) Before beginning to answer the paper, write your Roll Number in the space provided in the Question Booklet. On the OMR Answer Sheet, please fill in the details and sign at the appropriate place.

5) For each correct answer, candidate will be given 2 marks. 1 mark will be deducted for each wrong attempt. Zero marks will be given for no attempt.

6) Each objective type question is followed by four responses. Please mark the correct response by darkening the relevant CIRCLE with a BLUE/BLACK ball point pen on the OMR Answer Sheet. Darken ONLY ONE circle for each answer so that the letter inside the circle is not visible.

The CORRECT and the WRONG methods of darkening a circle are given below



7) Please DO NOT make any stray marks anywhere on the OMR Answer Sheet. DO NOT fold or wrinkle the OMR Answer Sheet. Rough work MUST NOT be done on the Answer Sheet. Use space provided in the Question Booklet for rough work. Rough sheets will be provided to you separately.

8) After completing the test, please hand over the Question Booklet to the Test Invigilator. DO NOT carry the Question Booklet or any part thereof outside the Examination Hall.

Part I - English Language

Directions for Questions 1-18:

Read both the paragraphs below well and answer all the questions that appear after each paragraph.

Passage 1

In the early morning of April 28, 2017, a small fireball crept across the sky over Kyoto, Japan. And now, thanks to data collected by the SonotaCo meteor survey, researchers have determined that the fiery space rock was a shard of a much larger asteroid that might, far down the road, threaten Earth. (1)

The meteor that burned over Japan was tiny. Studying the SonotaCo data, the researchers determined that the object entered the atmosphere with a mass of about 1 ounce (29 grams) and was just 1 inch (2.7 centimeters) across. It didn't threaten anyone. But small meteors like this are interesting because they can offer data on the bigger objects that spawn them. And in this case, the researchers tracked the little rock back to its parent: an object known as 2003 YT1. (2)

2003 YT1 is a binary asteroid, composed of one large rock about 1.2 miles (2 kilometers) across orbited by a smaller asteroid that's 690 feet (210 meters) long. Discovered in 2003, the binary system has a 6% chance of hitting Earth at some point in the next 10 million years. That makes the object what researchers call a "potentially hazardous object," even though it's unlikely to hurt anyone in your lifetime. The binary didn't pass by Earth in 2017, so there wasn't an immediately obvious link between the meteor and its parent. But the researchers studied how the fireball moved across the sky and were able to reverse-engineer the object's orbit through space, pinning it to 2003 YT1 with a high degree of certainty. (3)

The researchers said they aren't sure how the little rock split off from 2003 YT1 but believe it's part of a larger stream of dust that got flung off of the asteroid. And they offered a few potential explanations for how that stream formed: Maybe tiny micrometeorites routinely strike the bigger asteroid in the binary, fragmenting it like bullets striking a rock wall. Or maybe changes in heat cracked one of the asteroid's surfaces, spitting small pieces into the dark. (4)

One scenario the authors offered is that the shards are a result of the process that formed the 2003 YT1 system in the first place. Most people likely imagine asteroids as great, big rocks, scaled-up versions of the stones they'd find here on Earth. But 2003 YT1, the authors wrote, is more likely a "rubble pile," a jumble of stuff loosely bound together by gravity that coalesced into two orbiting bodies at some point in the last 10,000 years. The forces holding the masses together as individual asteroids are likely weak, and as the two piles spin chaotically around

one another, every couple of hours they could fling more of themselves into space. (5)

There are other, more exotic possibilities, the authors wrote. Water ice might be sublimating (turning from solid to gas) off one of the asteroids' surfaces and reforming as small balls of ice in open space. But that and other models are unlikely, the researchers wrote. For now, we know that Earth has been visited by a little part of a big asteroid. And that little part is likely itself a part of a stream of other little pieces that sometimes enter the Earth's atmosphere unnoticed. And at some point, far down the road, that big asteroid might follow its small children and slam into Earth. That fireball would be much, much bigger. (6)

(From: "Fireball That Flew Over Japan" by Rafi Letzter)

1) 1) According to the above passage, the fireball that flew over Kyoto:

- A) had a mass of about 27 grams and was 2.9 centimeters long.
- B) was small, yet large enough to threaten air safety for planes flying over the city.
- C) could tell us something scientifically valuable about its parent object.
- D) was one of the two bodies of a binary asteroid.

2) According to the passage, researchers are:

- A) not yet decided on the question of the origin of the fireball.
- B) undecided on whether the fireball can be conclusively traced to 2003YT1
- C) fairly certain that 2003YT1 is the origin of the fireball.
- D) fairly certain that 2003YT1 is a large asteroid.

3) The passage goes on to claim that:

- A) 2003YT1 is potentially harmless.
- B) The chances of 2003YT1 colliding with the earth are minimal because it is a binary asteroid.
- C) There is a small possibility of 2003YT1 colliding with the earth.
- D) There is a strong possibility of 2003YT1 colliding with the earth in our lifetime.

4) According to the passage, researchers believe that the Kyoto fireball:

- A) was definitely formed as a result of changes in temperature.
- B) is one of multiple possible fragments of the larger asteroid.
- C) has been conclusively proved to be the result of tiny meteorites striking the asteroid.
- D) is the only existing part of its parent object to be found in space.

5) In explaining how the Kyoto fireball came to be created, one possibility suggested by researchers is:

- A) Since the parent binary object is a loosely bound mass of material, its particles can regularly fly off as a result of its spinning movement.
- B) As the originating asteroid is a densely bound mass of material, its particles are held together by centripetal force.
- C) Because the larger asteroid is a binary entity, its two parts are in constant friction with each other, causing fragments to be created.
- D) Small balls of ice become strong enough in open space to batter against and begin breaking up much larger objects.

6) Which of the following words is closest in meaning to the word “shard” as used in the phrase “a shard of a much larger asteroid” (Para 1)

- A) Evidence
- B) Piece
- C) Solution
- D) Garbage

7) Which of the following words is closest in meaning to the word “spawn” as used in the sentence ending “...the bigger objects that spawn them.” (Para 2)

- A) Defeat
- B) Nourish
- C) Explain
- D) give birth to

8) Which of the following phrases has the closest opposite meaning to the word “fragmenting” as used in the phrase: “...fragmenting it like bullets striking a rock wall.” (Para 4)

- A) breaking into small pieces
- B) causing something to weaken
- C) helping to hold together
- D) converting solids into gases

9) What is the present tense of the word “sublimating” as used in the sentence beginning “Water ice might be sublimating” (Para 6)

- A) Sublime
- B) Subliminal
- C) Sublimate
- D) Sublimity

Passage 2

Each individual human being has a unique ancestral history, but a group of researchers set out to answer the ultimate question: Where do all humans come from? And it looks like they might have figured it out. Researchers claim in a new study that they have successfully traced the homeland of all modern humans to a region in northern Botswana.

“We’ve known for a long time that modern humans originated in Africa roughly 200,000 years ago,” said the study’s co-author, geneticist Vanessa Hayes of the Garvan Institute. “But what we hadn’t known until the study was where exactly this homeland was.” The area that scientists have traced our supposed origins to is a place called Makgadikgadi-Okavango, where an enormous lake once stood. Scientists believe the area was home to a population of modern humans for at least 70,000 years. “It’s an extremely large area, it would have been very wet, it would have been very lush,” Hayes said. “And it would have actually provided a suitable habitat for modern humans and wildlife to have lived.” (1)

Some of the population began to migrate about 130,000 years ago after the region’s climate started to change, thus sparking the first migration of humans out of the continent. Scientists suspect there were waves of separate migrations, first toward the northeast and then toward the southwest. These early waves of human migration were determined based on hundreds of mitochondrial DNA — the part of a person’s genes passed down from their mother — of living Africans. (2)

So how did the scientists trace our common ancestors back to Botswana? According to the study published in the journal *Nature* researchers used modern genetic distributions to trace a specific lineage all the way back to its homeland origins. In this case, they analyzed DNA samples from 200 Khoisan people, an ethnic group in South Africa and Namibia, who carry a high amount of the L0 DNA. The L0 DNA is believed to be the oldest traceable DNA present among modern-day humans. Researchers then compared DNA samples with data from other external factors, such as climate change, geographical distribution, and archaeological shifts to create a genomic timeline. The timeline suggested a sustained lineage of L0 that stretched back 200,000 years. (3)

One of the biggest hurdles for scientists in tracing human ancestry is navigating the different migrations that occurred when ancient humans were roaming the Earth. But Hayes sees these migration events as “timestamps” on our DNA. “Over time our DNA naturally changes, it’s the clock of our history,” Hayes explained to *AFP*. (4)

It’s an exciting discovery for humankind, no doubt. But not everyone is convinced of the study’s conclusion. For one, there have been humanoid fossil remains believed to pre-date the L0 lineage benchmark. There are also complexities brought on by several factors that researchers need to consider when trying to narrow down the source of our collective DNA, as researcher Chris Stringer from the UK’s Natural History Museum pointed out. (5)

“Like so many studies that concentrate on one small bit of the genome, or one region, or one stone tool industry, or one ‘critical’ fossil, it cannot capture the full complexity of our mixed origins, once other data are considered,” Stringer said in a statement posted on Twitter. Stringer argued that previous findings have suggested that the Y-chromosome in modern humans likely came from West Africa, not Southern Africa where Botswana is, which underscores the possibility that our ancestors came from multiple homelands instead of one. (6)

He also cited a separate study published in the journal *Science* that suggested “Southern African populations did not represent ancestors for the rest of humanity, and out-of-Africa populations originated in East Africa.” In any case, both of Stringer’s arguments could potentially rule out Botswana as the origins of modern humans. There is still much debate on the subject — and more research to be done — but studies that seek to determine where we came from all help us get closer to finding out our prehistoric origins. (7)

(From ‘Researchers Traced The Ancestral Homeland of Modern Humans to Botswana’ by Natasha Ishak)

10) The above passage refers to a study that makes the following important claim:

- A) Modern humans originated in Asia roughly 200,000 years ago.
- B) Modern humans definitely originated in North Africa.
- C) Modern humans originated in a place in Botswana that was once a large forest.
- D) Modern humans originated in a place in Botswana that was once the site of a large lake.

11) According to the passage, the same study suggests that:

- A) The first humans were born in Africa about 130000 years back.
- B) Early humans migrated out of their first homeland about 130000 years ago.
- C) It took 70000 years for our early ancestors to evolve into full humans.
- D) The region’s climate started to change about 70000 years ago.

12) Explaining how researchers came to formulate their theory, the author of the passage tries to show the connection between:

- A) Ancient humans and our prehistoric animal ancestors
- B) Ancient humans and their early homeland
- C) Modern humans and prehistoric humans linked by a particular DNA strand
- D) Modern humans and their fertile environment

13) According to the author of the passage, which of the following may disprove the theory cited in the early paragraphs?

- A) Some fossil remains are believed to contain more convincing evidence than L0 DNA.
- B) The Y-chromosome is not found in L0 DNA.
- C) The L0 DNA is believed to be the oldest traceable DNA present among modern-day humans.
- D) Some fossil remains are believed to contain DNA that is older than L0 DNA.

14) The author cites the opinion of an expert to support the idea that:

- A) A single piece of evidence is always crucial to decisions about tracing DNA.
- B) When forming a theory about DNA, a single piece of evidence is not enough to correctly reflect the varied nature of human origins.
- C) Researchers are in complete agreement on what constitutes evidence in respect of the DNA of our early ancestors.
- D) There are no other significant factors that might change theories about origins that are based on tracing DNA.

15) Which of the following sentences contains the future tense of the phrase: "...it would have been very lush."
(Para 1)

- A) it was very lush
- B) it was going to be very lush
- C) it will be very lush
- D) it was becoming very lush

16) Which of the following word or phrases is closest in meaning to the word "habitat" as used in the phrase "a suitable habitat for modern humans and wildlife".
(Para 1)

- A) an area good for hunting and fishing
- B) a fertile territory for agriculture
- C) a place to live in
- D) a location in which human remains were discovered

17) Which of the following words or phrases is closest in meaning to the word "navigating" as used in the phrase "navigating the different migrations". (Para 4)

- A) sailing a ship
- B) choosing a direction
- C) coming to a conclusion
- D) finding no proof

18) Which of the following phrases is closest in meaning to the word "underscores" as used in the sentence ending "which underscores the possibility that our ancestors came from multiple homelands instead of one." (Para 6)

- A) makes an idea clearer
- B) emphasizes or draws attention
- C) denies the truth of an idea
- D) adds additional evidence

Part II – Quantitative Reasoning

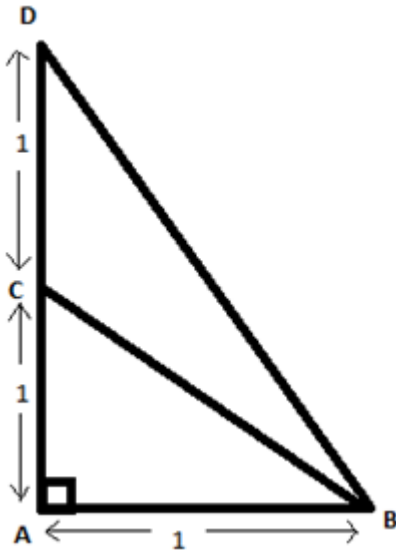
19) Suppose X is 4% of 30 and Y is 2% of 70. Then

- A) $4X=2Y$
- B) X is bigger than Y
- C) $2X = 4Y$
- D) Y is bigger than X

20) The average of the numbers 5, -6, X and Y is 5. Which of the following has to be true?

- A) $X = 7, Y = 9$
- B) X and Y must lie in between -6 and 5
- C) $X+Y=21$
- D) Both X and Y must be positive

21) In the figure below, which of the following is true?

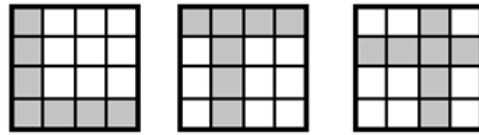


- A) We do not have enough information to compare the areas of triangles ABC and CBD
- B) The area of triangle ABC is larger than the area of triangle CBD
- C) The area of triangle ABC is smaller than the area of triangle CBD
- D) The area of triangle ABC equals the area of triangle CBD

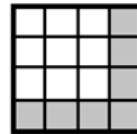
22) A goat needs 2.5 kg of grass per day. If you have 200 kg of grass, for how many days can you feed two goats?

- A) 20 days
- B) 40 days
- C) 50 days
- D) 100 days

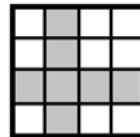
23) Which shape comes next in the pattern below?



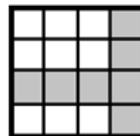
A)



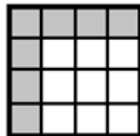
B)



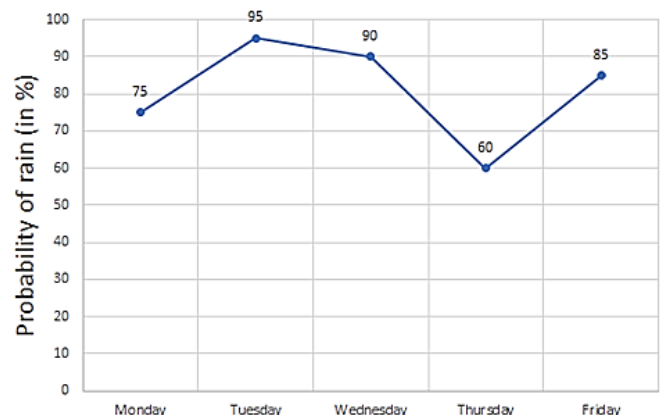
C)



D)



24) The graph below shows the probability of rain in Bangalore for the coming week.



Which of the following is true?

- A) If it does not rain on Tuesday, it will not rain on Thursday
- B) If it does not rain on Tuesday, it has to rain on Wednesday
- C) It will definitely rain some time during the week
- D) It is possible that there will be no rain on both Thursday and Friday

25) A shopkeeper has 40 kg of white rice and 20 kg of red rice. 6% of the white rice and 3% of the red rice are spoilt. All together, what percentage of the rice is spoilt?

- A) 5%
- B) 4.5%
- C) 9%
- D) 3%

26) The following table shows the cost of travelling in a bus for various distances.

D = Distance (In Kms)	2	4	6	8	10	12	14
F = Bus Fare (in Rs.)	6	8	10	10	12	12	15

Which of the following is correct?

- A) $F = 2D$
- B) $F \geq 2D$
- C) $F \leq 2D$
- D) None of the above formulas is true.

27) An oval bicycle track is 1 km long and the total distance for the race is 9.5 km. Cyclist 1 is going at an average speed of 15 km/hr and Cyclist 2 is going at an average speed of 30 km/hr.

- A) Cyclist 2 will never meet Cyclist 1
- B) The two cyclists will meet exactly once
- C) The two cyclists will meet nine times
- D) The two cyclists will meet four times

28) Which of the following is correct?

- A) $5/40 > 4/30$ and $4/30 < 3/20$
- B) $5/40 > 4/30 > 3/20$
- C) $3/20 > 4/30 > 5/40$
- D) $5/40 = 4/30 = 3/20$

29) If you have a cardboard circle of radius 3 cm, and cut out a square of side 1 cm, what is the area of the remaining shape?

- A) $6\pi - 4$
- B) $3\pi - 1$
- C) $9\pi - 1$
- D) $6\pi - 1$

30) You have to choose a password consisting of three whole numbers between 0 and 9. You are allowed to repeat digits, but the order of the digits matters. You also cannot choose a password in which all three digits are the same (like 111 or 222) or one that begins with 0 (like 012). How many options do you have?

- A) Over 10,000
- B) Between 1000 and 9,999
- C) Between 500 and 999
- D) Fewer than 499

31) P is a smaller number than Q. If you subtract 2 from Q, you get R. Which of the following is true?

- A) P is bigger than R
- B) R is bigger than P
- C) Q is smaller than R
- D) We cannot say which of P and R is bigger

32) Suppose $xy = 1$ and $y = 20$. Then x equals

- A) 0.05
- B) 0.2
- C) 0.02
- D) 0.5

33) In a class with 50 students, 26 are taking biology and 25 are taking maths. Which of the following is true?

- A) No more than one student is taking both biology and maths
- B) At least one student is taking both biology and maths
- C) Exactly one student is taking both biology and maths
- D) This situation is not possible

Space for Rough Work: