

**MATHEMATICS - ALGEBRA**

1. The number of women and men in a company are proportional to 2 and  $\frac{1}{2}$ , respectively. If the number of all workers in the company is 160, then the number of women is:

*Uwiano wa namba ya wafanyakazi wa kike na kiume kwenye shirika ni 2 na  $\frac{1}{2}$ , kama jumla ya wafanyakazi wote ni 160, tafuta namba ya wanawake.*

- A) 128  
B) 32  
C) 64  
D) 100

2. Ali's age is one third of his mother and his mother's age is three quarters of his father. How old is the mother if the sum of ages of father and mother is 112?

*Umri wa Ali ni moja ya tatu ya mama yake, na umri wa mama yake ni tatu ya nne ya baba yake. Mama ana miaka mingapi kama jumla ya umri wa baba na mama ni 112.*

- A) 64  
B) 16  
C) 48  
D) 20

3. A man invested a certain amount of money into a business with constant profit. He had TSH 1,700,000 in four months and got TSH 2,100,000 in six months. How much money did he invested?

*Mtu mmoja aliwekeza fedha kaatika biashara kwa faida iliyosawa. Alipata shilingi 1,700,000 kwa miezi mine na kupata shilingi 2,100,000 kwa miezi sita. Je aliwekeza kiasi gani?*

- A) TSH 900,000  
B) TSH 1,000,000  
C) TSH 1,100,000  
D) TSH 1,200,000

4. What is  $x$ , if  $2x/3 - (x-2)/4 = 7(1-x)/6$

*Tafuta thamani ya  $x$  kama  $2x/3 - (x-2)/4 = 7(1-x)/6$*

- A) 0  
B)  $1/2$   
C)  $8/19$   
D)  $19/20$

5. A tank leaks 1 liter in one hour. I add 100 liters to the half of the tank in five hours. The two thirds of the tank is full after five hours. What is the capacity of the tank?

*Tanki linavujisha lita 1 kwa saa moja. Niliongeza lita 100 katika tanki lililokuwa nusu, kwa masaa matano. Tanki lilijaa kwa theluthi mbili baada ya masaa matano. Je upi uwezo wa tanki?*

- A) 560
- B) 570
- C) 600
- D) 620

6. The list price of a computer monitor is TSH 300,000. The selling price is TSH264,000. What is the percentage discount?

*Bei ya kumpyuta ni Tsh. 300,000, na bei ya kuuzia ni Tshs. 264,000. Punguzo ni asilimia ngapi?*

- A) 10
- B) 12
- C) 15
- D) 20

7. Brian is 3 times as old as his sister will be in 5 years and their age difference is 19. How old is Brian?

*Umri wa Brian ni mara tatu ya dada yake baada ya miaka 5, kama tofauti ya miaka yao ni 19. Brian ana miaka mingapi?*

- A) 2
- B) 10
- C) 15
- D) 21

8. A class consisting of 20 students has participated in the semi-final of the Genius-cup competition, where one could obtain between 0 and 20 points. Three of the students obtained exactly the class's average. If each of the students that scored below the average had scored 4 points more, the average would have been 3 points higher. How many students scored above the class's average?

*Darasa lenye wanafunzi 20 walishiriki katika nusu fainali ya mashindano ya Genius Cup, ambapo mshiriki atapata pointi kati ya 0 na 20. Wanafunzi watatu walipata pointi sawa kabisa na wastani wa darasa. Endapo kila mwanafunzi aliyepata chini ya wastani wa darasa, angepata pointi 4 zaidi, wastani ungekuwa pointi 3 zaidi. Je ni wanafunzi wangapi wamepata poit za juu zaidi ya wastani wa darasa?*

## GEOMETRY

9. A rectangle has a perimeter of 320 meters and its length  $L$  is 3 times its width  $W$ . Find the area of the rectangle.

*Msatili una mzingo wa meta 320m na urefu wake ni mara 3 ya upana wake. Tafuta eneo la mstatili.*

- A) 4,600
- B) 4,800
- C) 5,000
- D) 5,200

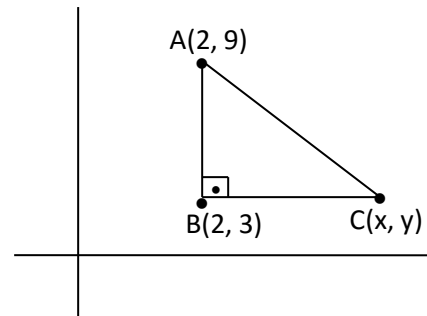
10. Find the area of quadrilateral ABCD whose vertices are  $A(-2, 0)$ ,  $B(2, 4)$ ,  $C(2, 1)$  and  $D(1, 0)$ .

*Tafuta eneo la pembe nne ABCD lenye nyuso A) (-2, 0), B) (2, 4), C) (2, 1) na D) (1, 0)*

- A) 7.5
- B) 8.5
- C) 9.5
- D) 10.5

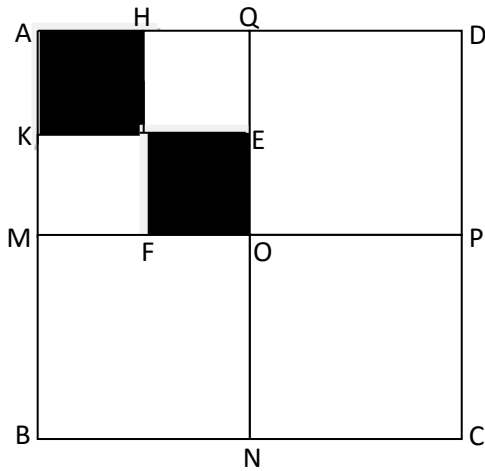
11. The right triangle shown below has an area of 24 units. Find the hypotenuse.

*Kama eneo la pembe tatu ni 24m<sup>2</sup>. Tafuta urefu*



- A) 14
- B) 12
- C) 10
- D) 8

12.

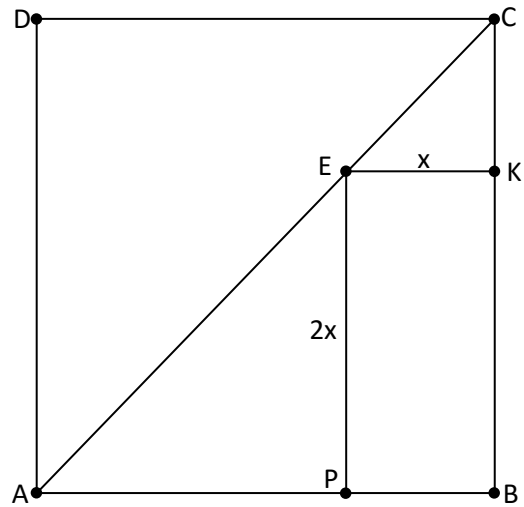


Rectangle ABCD has a length of 12 cm and a width of 8cm. What is the total area of the black rectangles?  
 $AH = HQ$ ,  $AK = KM$ ,  
 $BN = NC$  and  $AM = MB$

*Mstatili ABCD wenye urefu wa sm 12 na upana wa sm 8. Nini eneo la sehemu yenye kivuli.*

- A) 18
- B) 16
- C) 14
- D) 12

13.



ABCD is a square. PBKE is a rectangle E is on the line of AC.  
 $|DC| = 6$  unit,  $|EK| = x$  unit,  $|EP| = 2x$  unit. So, what is the  $|EK| = x$ ?

*ABCD ni mraba. PBKE ni mstatili na pointi E ipo kwenye mstari AC.*

$|DC| = 6$ ,  $|EK| = x$ ,  $|EP| = 2x$ .  $|EK| = x$ ?

- A) 2
- B) 4
- C) 6
- D) 8

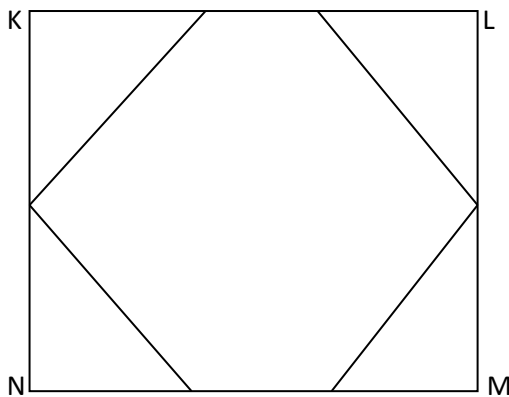
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14. KLMN is a square. KL and MN are divided into 3 equal parts. KN and LM are divided into 2 equal parts.

Find  $\frac{\text{area of hexagon}}{\text{area of square}}$

*KLMN ni mraba. KL na MN zimegawanywa sawa katika sehemu tatu zilizo sawa. KN na LM zimegawanya katika sehemu mbili*

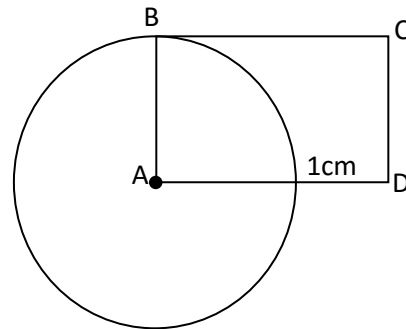
*zilizosawa.  $\frac{\text{Eneo la pembe sita}}{\text{Eneo la mraba}}$  ni*



- A)  $\frac{1}{2}$
- B)  $\frac{1}{3}$
- C)  $\frac{2}{3}$
- D)  $\frac{3}{4}$

15. ABCD is a rectangle with one vertex at the centre of the circle. What is the length of AC if the area of the circle is  $27\text{cm}^2$  if the remaining part of the length is 1 cm? ( $\pi = 3$ )

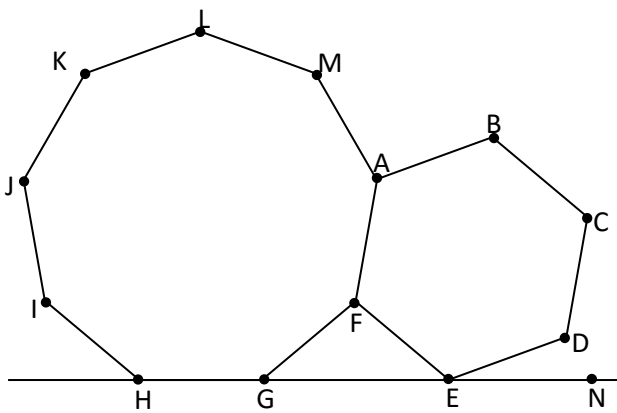
*ABCD ni mstatili yenye pembe moja katikati ya duara. Nini urefu wa AC iwapo eneo la duara ni  $27\text{cm}^2$  ikiwa urefu wa sehemu iliyobaki ni  $1\text{cm}$ ?*



- A) 3
- B) 4
- C) 5
- D) 6

16. In the diagram below, a regular 9-sided (nonagon) and a regular 6-sided (hexagon) polygons are joined at side AF. The straight line HGN passes through the vertex E of the hexagon. Calculate the size of angle DEN.

*Katika mchoro ufuatao, poligoni ya pembe tisa sawa na poligoni ya pembe sita sawa zimeunganishwa katika upande AF. Msatari HGN umepita katika point E. Tafuta ukubwa wa pembe DEN.*



## COMBINATORICS

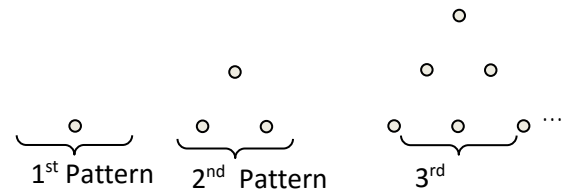
17. We wrote only one of these numbers 1, 2, 3, 4, 5, 6 on each face of two identical solid cubes. We made a block placing one cube on top of the other. What is the sum of the hidden numbers if there is only one possible sum?

*Kama tukiandika moja kati ya namba zifuatazo (1, 2, 3, 4, 5, 6) kwenye kila uso wa maumbo mraba mawili (yanayofanana) halafu tukaweka umbo mraba moja juu ya lingine. Ni ipi jumla ya namba mbili zilizofichwa (baada ya maumbo hayo kukutanishwa) kama kuna jumla moja tu inayoweza kupatikana?*

- A) 3
- B) 6
- C) 9
- D) 12

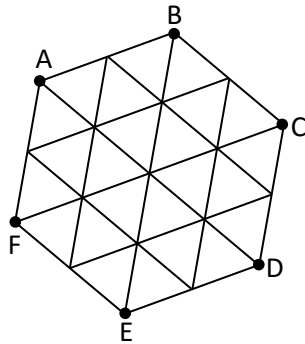
18. Small bottles are arranged in the following patterns. How many bottles are there in the 8th pattern?

*Chupa ndogo zimepangwa katika mpangilio ufuatao. Kuna chupa ngapi katika mgangilio wa nane?*



- A) 15
- B) 36
- C) 64
- D) 63

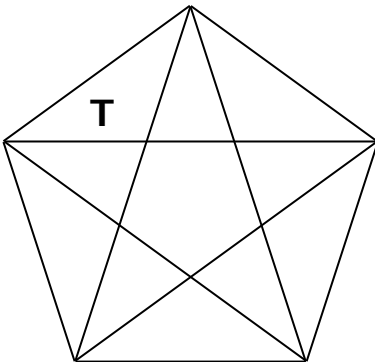
19. A regular hexagon ABCDEF with side 2 units in the figure is divided into small hexagons by the line segments. How many hexagons are there?



*Kuna pembe sita sawa ndogo kutoka kwenye pembe sita sawa ABCDEF lenye kila upande 2 unit?*

- A) 6
- B) 7
- C) 8
- D) 9

20.



How many triangles of regular pentagon in the figure contain letter T?

*Kuna pembe tatu ngapi katika pembe tano sawa katika mchoro wenye hefuri T?*

- A) 6
- B) 7
- C) 8
- D) 9

21. A man has three white and two red hats he can put on only one hat but he does not wear same colored-hat in consecutive days. In how many ways that man wear the hats in three consecutive days?

*Mtu ana kofia tatu nyeupe na mbili nyekundu anaweza kuvaa tu kofia moja lakini hawezi kuvaa kofia zenye rangi moja kwa siku mfululizo. Ni kwa njia ngapi anaweza kuvaa kofia katika siku tatu mfululizo?*

- A) 10
- B) 12
- C) 8
- D) 4

22. Julian started reading a book one page from the beginning and one page from the end in turn. If the last page she read 41st from the beginning, then what is the number of pages?

*Julian alianza kusoma kusoma kitabu cha kwanza kutoka mwanzo wa ukurasa na kutoka mwisho wa ukurasa. Ikiwa ukurasa wa mwisho ni 41 kutoka mwanzo. Je alisoma kurasa ngapi?*

- A) 80
- B) 81
- C) 82
- D) 84

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23. How many straight lines can be formed by 5 points of which 3 are collinear?

*Mistari mingapi minyoofu inayoweza kutokea kwa nukta 5 ikiwa mistari 3 imelaliana?*

- A) 7
- B) 8
- C) 9
- D) 10

24. There are three letters and two mailboxes. In how many ways can the letters be put into the mailboxes such that at most one box is empty?

## NUMBER THEORY

25.  $1a0b$  is a 4-digit number which is divisible by 4. When the digits in ones and in hundreds are exchanged, it is still divisible by 4. What is the sum of the possible values of  $b$ ?

*$1a0b$  ni tarakimu 4 za namba ambazo zinagawanyika kwa 4. Ikiwa tarakimu ya mamboja na mamia zikibadilishwa, lakini bado zinagawanyika kwa 4. Nini ni jumla ya uwezekano wa namba za  $b$ ?*

- A) 10
- B) 12
- C) 8
- D) 4

26. The product of three different integers is 91. What is the minimum value of the sum?

*Namba tatu tofauti zikizidishwa ni 91. Ni ipi jumla ndogo ya namba hizo?*

- A) -89
- B) 21
- C) -19
- D) 93



27. The traffic lights at three different roundabouts change after 40 seconds, 60 seconds and 50 seconds. If all the lights changed at 7:00 A.M, at what time will all the three lights change again?

*Ikiwa taa za usalama barabarani katika mizunguko mitatu tofauti inabadilika kila baada ya dakika 40, dakika 60, na dakika 50. Ikiwa taa zote zinabadilika saa 7:00 asubuhi. Ni mda upi zote kwa pamoja zitabadilika tena?*

- A) 9:00 A.M
- B) 7:10 A.M
- C) 7:40 A.M
- D) 8:10 A.M

28. What is the sum of possible values of  $b$  if 6-digit number  $9304b4$  is divisible by 4?

*Ni ipi jumla ya uwezekano wa namba  $b$  ikiwa tarakimu 6 za namba  $9304b4$  zimegawanyika kwa 4?*

- A) 20
- B) 18
- C) 16
- D) 14

29. Product of ages of three brothers is 21 and the two brothers are twins. What is the age difference between eldest brother and the twins?

*Jumla ya miaka ya kaka watatu ni 21 na kaka wawili ni mapacha. Ni ipi tofauti ya miaka kati ya kaka mkubwa na mapacha?*

- A) 4
- B) 20
- C) 21
- D) 23

30.  $5p + 6$  is a square of a prime number and  $p$  is 2-digit prime number. What is the sum of possible values of  $p$ ?

*$5p + 6$  ni kipeuo cha namba tasa na  $p$  ni tarakimu 2 za namba tasa. Ni ipi jumla ya uwezekano wa namba  $p$ ?*

- A) 92
- B) 94
- C) 96
- D) 98

31. How many zeros will be at the end of the number  $\underbrace{111 \dots 111}_{99 \text{ times}} \times 11 + \underbrace{777 \dots 79}_{99 \text{ digits}}$  after the operations performed?

*Tariq anaenda kupanda miti, 54 mialori, 45 michungwa, 36 minanazi. Tariq alipenda kupanda miti ya aina moja katika mistari. Ni namba ipi kubwa tariq anaweza kupanda kila mstari?*

- A) 95
- B) 97
- C) 98
- D) 99

32. Tariq is going to plant 54 oak trees, 45 orange trees and 36 pine trees. Tariq would like to plant the trees in rows that all have the same number of trees and are made up of only one type of tree. What is the greatest number of trees Tariq can have in each row?

## SCIENCE

33. Separation of mixture by fractional distillation is possible if the mixture constituents differ in their:

*Kutenganisha mchanganyiko kwa njia ya kupoza mvuke kwa awamu itawezekana ikiwa vinavyounda mchanganyiko huo vinatofautiana kwa:*

- A) Boiling point (Joto la kuchemsha)
- B) Melting point (Joto la kuyeyusha)
- C) Density (Tungano)
- D) Physical state (hali ya umbile)

34. Which one of the following is an element?

*Ni ipi kati ya zifuatazo ni elementi?*

- A) Water (Maji)
- B) Carbondioxide (Karbonidioksidi)
- C) Salt (Chumvi)
- D) Sodium (Sodiamu)

35. In a circuit diagram, what does a circle with a cross inside it represents?

*Katika mchoro wa sakiti ya umeme, duara lenye X ndani yake hukaa badala ya nini?*

- A) A motor (Mota)  
B) A bulb (Glopu)  
C) Voltmeter (Amita)  
D) Wire (Waya)

36. Why do shadows made by the sun move over the course of a day?

*Kwanini kivuli cha jua huhamahama wakati wa mchana?*

- A) Because the weather changes  
*Kwasababu ya mabadiliko ya hali ya hewa*  
B) Because the objects keep moving  
*Kwasababu vitu vinajongea*  
C) Because the sun appears to move across the sky each day  
*Kwasababu jua linajongea kukatisha anga kila siku.*  
D) Because the shape of the object change  
*Kwasababu umbile la kitu linabadilika*

37. An empty bottle has a mass of 100 g. When it is full with water, the total mass is 200 g but when filled up with a given liquid, the mass becomes 250 g. Find density of the liquid?

*Chupa tupu ina uzito wa gramu 100. Ikiwa imejaa maji ina jumla ya uzito wa gramu 200 lakini inapokuwa imejazwa oevu nyingine huwa na uzito wa gramu 250. Tafuta tungamo ya oevu.*

- A) 15 g/cm<sup>3</sup> (g/sm<sup>3</sup> 15)  
B) 1.5 g/cm<sup>3</sup> (g/sm<sup>3</sup> 1.5)  
C) 0.25 g/cm<sup>3</sup> (g/sm<sup>3</sup> 0.25)  
D) 2.5 g/cm<sup>3</sup> (g/sm<sup>3</sup> 2.5)

38. At what height must a 3000 g body be positioned so that its potential energy will be 3000 J?

*Ni kimo gani kitu chenye uzito wa gramu 3000 kitawekwa ili nishati tuli yake iwe jouli 3000?*

- A) 100 m (m 100)  
B) 100 cm (sm 100)  
C) 10 m (m 10)  
D) 90 cm (sm 90)

39. For the same applied force, if the area decreases the pressure

*Kama kani iliyotumika haibadiliki na eneo likawa linapungua, mgandamizo*

- A) Remains same (*Hautobadilika*)
- B) Decreases (*Utapungua*)
- C) Increases (*Utaongezeka*)
- D) First increase then decrease (*Utaongezeka kwanza halafu utapungua*)

40. Which one of the following is an effect of force?

*Ni ipi kati ya vifuatavyo ni matokeo ya kani?*

- A) Change of state (*Badiliko la hali*)
- B) Change of direction (*Badiliko la uelekeo*)
- C) Boiling (*Kuchemsha*)
- D) Increase in mass (*Kuongezeka uzito*)

41. What is myopia?

*Nini maana ya kutokuona mbali?*

- A) The inability of the eye to focus on distant objects (*Jicho kushindwa kuona vitu vya mbali*)
- B) The inability of the eye to focus on nearby objects (*Jicho kushindwa kuona vitu vya karibu*)
- C) The ability of the eye to focus on distant objects (*Uwezo wa jicho kuona vitu vya mbali*)
- D) None of the above (*Hakuna jibu*)

42. Which one of the following has the largest population in a food chain?

*Ni lipi kati ya yafuatayo linakundi kubwa kwenye mlolongo wa chakula?*

- A) Producers (*Wazalishaji*)
- B) Primary consumers (*Walaji wa mwanzo*)
- C) Secondary consumers (*Walaji wa pili*)
- D) Decomposers (*Waozeshaji*)

**43. What cell feature is responsible for storing water?**

*Ni sehemu gani ya seli inayohifadhi maji?*

- A) Mitochondria** (*Mitokondria au dutuvuo*)
- B) Cytoplasm** (*Utegili*)
- C) Nucleus** (*Kiini cha seli*)
- D) Vacuole** (*Vakyuli*)

**45. A patient whose cerebrum is surgically removed is most likely to have problems with**

*Mtu aliyetolewa ubongo wa mbele anauwezo wa kuwa na tatizo la*

- A) Memory** (*Kumbukumbu*)
- B) Breathing** (*Upumuaji*)
- C) Heart beat** (*Mapigo ya moyo*)
- D) Walk** (*Kutembea*)

**44. The chemical substance used to identify glucose is called**

*Kemikali inayotumika kugundua glukosi inaitwa*

- A) Litmus paper** (*Karatasi ya litmas*)
- B) Lime water** (*Maji ya laimu*)
- C) Iodine** (*Madini joto*)
- D) Benedict solution** (*Solusheni ya Benedict*)

**46. Each identical twin that has down syndromes has ....**

*Kila mapacha wawili wenye down sindromu huwa na*

- A) 23 chromosomes** (*Kromozomu 23*)
- B) 46 chromosomes** (*Kromozomu 46*)
- C) 24 chromosomes** (*Kromozomu 24*)
- D) 47 Chromosomes** (*Kromozomu 47*)

47. Most of the red, blue and purple colours of plants are due to a pigment called

*Kiwango kikubwa cha rangi nyekundu, bluu na zambarau kwenye mmea hutokana na chembechembe za*

- A) Corolla (Korola)
- B) Carotene (Karotini)
- C) Calyx (Kaliksi)
- D) Xanthophyll (Zanthofili)

48. Which of the following organism makes food and other organisms depend on them for food?

*Ni kiumbe yupi hutengeneza chakula kwa ajili yake na kwa ajili ya wengine?*

- A) Heterotrophs (Heterotrof)
- B) Herbivores (Hebivore)
- C) Autotrophs (Autotrof)
- D) Decomposers (Waozeshaji)

49. Photosynthesis takes place faster in  
*Fotosinthesisi hutumika haraka kwenye*

- A) Yellow light (Mwanga njano)
- B) White light (Mwanga mweupe)
- C) Red light (Mwanga mwekundu)
- D) Darkness (Gizani)

50. Potato is a modified form (outgrowth) of

*Viazi mbatata huibuka kutokana na*

- A) Root (Mizizi)
- B) Stem (Shina)
- C) Fruit (Tunda)
- D) Leaf (Jani)

51. Plant have \_\_\_\_\_ while animals lack it.

*Mimea ina \_\_\_\_\_ wakati wanyama hawana.*

- A) Starch (Wanga)
- B) Fat (Fati)
- C) Protein (Protini)
- D) Cellulose (Selilozi)

52. Which one of the following is found in exhaled air?

*Ni ipi kati ya zifuatazo ipo kwenye hewa itokayo nje wakati wa upumuaji?*

- A) 4% O<sub>2</sub>
- B) 16% O<sub>2</sub>
- C) 0.03% O<sub>2</sub>
- D) 20.9% O<sub>2</sub>

53. Three resistance of 15 ohm, 5 ohm and 3 ohm are connected parallel to each other. This combination is connected series to a resistance of 5 ohm. If the p.d. is 20 V, calculate the current of the circuit?

*Kinzani tatu zenye omu 15, omu 5 na omu 3 zimeunganishwa sambamba kila moja. Muunganiko huo umeungwa tena kwa mfuatano na ukinzani wenye omu 5. Ikiwa chanzo kinatoa 20V, tafuta umeme katika sakiti.*

54. Draw electron configuration of Carbon which has 6 electron.

*Chora mfumo wa elektroni wa kaboni yenye elektroni 6.*