CLASS

9

BVPY QUESTION PAPER – STAGE 2

Feb. 07, 2021

Part A – Mathematics (Q1 to Q30)

Part B – Science (Q1 to Q30)

Maximum Marks: 100 **Duration : 180 minutes**

Instructions for Students :

1. This paper consists two parts i.e. Part 'A' (Mathematics) Q.1 to 30, Part 'B'(Science) Q1 to 30.
2. For rough work please use last two pages.

PART 'A' (MATHEMATICS)

SECTION 1 (Maximum Marks: 15)

- This section contains Q.1 to Q. 15.
- Each question has **FOUR** options 'A', 'B', 'C' and 'D'. **ONLY ONE** of these four options is correct
- For each question, marks will be awarded in one of the following categories:

Full Marks : +1 If only the bubble corresponding to the correct option is darkened

Zero Marks : 0 If none of the bubbles is darkened

Negative Marks : –0.25 In all other cases

1. If length, breadth and height of a cuboid are increased, decreased and increased by 1%, 3% and 2% respectively, then the volume of the cuboid _____.

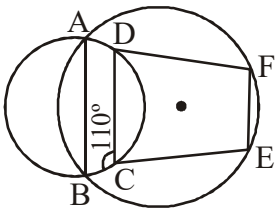
A. Increases

B. Decreases

C. Increases or decreases depending on original dimensions

D. Can't be calculated with given data

2. In given figure, $ABCD$ and $ABEF$ are two cyclic quadrilaterals. If $\angle BCD = 110^\circ$, then $\angle BEF = ?$



A. 55° B. 70°

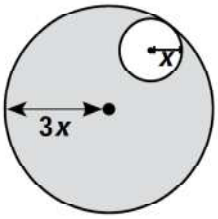
C. 90° D. 110°

3. The value of $3\left[\dfrac{(a^2-b^2)^3+(b^2-c^2)^3+(c^2-a^2)^3}{(a-b)^3+(b-c)^3+(c-a)^3}\right] = ?$

A. $3(a+b)(b+c)(c+a)$ B. $3(a-b)(b-c)(c-a)$

C. $(a-b)(b-c)(c-a)$ D. 1

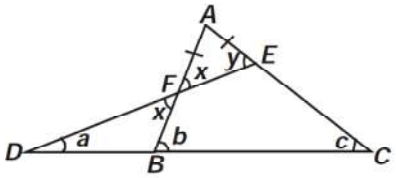
4. Two circles have radii x and $3x$. A point is chosen, at random, inside the larger circle. Find, in its simplest fractional form, the probability that this point is in the shaded area.



A. 7/8 B. 8/9

C. 1/9 D. 1/8

5. In the adjacent figure $AE = AF$, then which of the following is true?



A. $a + b + c = 180°$ B. $a + c = b$

C. $2c + a = b$ D. $2a + c = b$

6. The area of the triangle formed by $2x + 3y = 6$ and the coordinate axes is ____.

A. 3 sq. units B. 2 sq. units

C. 6 sq. units D. 5 sq. units

7. If $(x - 1)$, $(x + 1)$ and $(x - 2)$ are factors of $x^4 + (p - 3)\,x^3 - (3p - 5)\,x^2 + (2p - 9)\,x + 6$ then the value of p is

A. 1 B. 2

C. 3 D. 4

8. The number of coins of radius 0.75 *cm* and thickness 0.2 *cm* to be melted to make a right circular cylinder of height 8 *cm* and base radius 3 *cm* is:

A. 460 B. 500

C. 600 D. 640

9. The value of p upto 35 decimal places is given as : 3.14159265358979323846264338327950288.
Find the probability of occurring 8 in it.

A. 1/7 B. 1/5

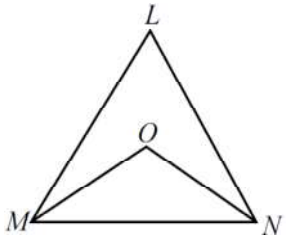
C. 5/36 D. 1/3

10. A pen costs Rs 13 and a notebook costs Rs 35. Let m be the maximum number of items that can be bought for Rs 1000 and n be the minimum number of items that can be bought for the same amount. Then $m + n$ is :

A. 76 B. 88

C. 96 D. 98

11. In figure, $\angle L = 62^\circ$, $\angle LMN = 54^\circ$. If MO and NO are bisectors of $\angle LMN$ and $\angle LNM$ respectively of ΔLMN, find $\angle ONM$ and $\angle MON$.



A. 27°, 121° B. 32°, 121°

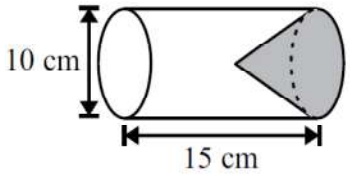
C. 64°, 121° D. 64°, 32°

12. The value of $\sqrt{6+2\sqrt{3}+2\sqrt{2}+2\sqrt{6}} - \frac{1}{\sqrt{5-2\sqrt{6}}}$ is

A. 2 B. –1

C. $\sqrt{3}+\sqrt{2}$ D. 1

13. The given diagram shows a cylinder with a diameter of 10 *cm* and height 15 *cm*. The shaded portion in the form of a cone, with base diameter 10 *cm* and height 6 *cm*, is hollowed out. Find the volume of the remaining solid, in cm^3.



A. 300 π B. 345 π

C. 325 π D. 295 π

14. If $a - b = 3$, $a + b + x = 2$, then the value of $(a - b)\,[x^3 + 3(a + b)x^2 + 3x(a + b)^2 + (a + b)^3]$ is

A. 84 B. 48

C. 32 D. 24

15. If p and q are rational numbers and $\frac{5+\sqrt{11}}{3-2\sqrt{11}} = p + q\sqrt{11}$, then find the values of p and q respectively.

A. $\frac{37}{35}, \frac{-13}{35}$ B. $\frac{37}{35}, \frac{13}{35}$

C. $\frac{-37}{35}, \frac{-13}{35}$ D. $\frac{-37}{35}, \frac{13}{35}$

SECTION 2 (Maximum Marks: 20)

- This section contains Q.16 to Q. 25.
- Each question has **FOUR** options 'A', 'B', 'C' and 'D'. **ONLY ONE** of these four options is correct
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Zero Marks : 0 If none of the bubbles is darkened

Negative Marks : –0.50 In all other cases

16. The base of an isosceles triangle is 4 *cm* and its area is 16 cm^2. If one of the two equal sides of the triangle is k *cm*, the approximate value of $k - 1.24$ is _____.

A. 9 *cm* B. 7 *cm*

C. 10 *cm* D. 8 *cm*

17. If $(x-2y)^6 = A_0x^6 - A_1x^5.y^1 + A_2x^4.y^2 - A_3x^3.y^3 + A_4x^2.y^4 - A_5x.y^5 + A_6y^6$, find the value of $A_0 - A_1 + A_2 - A_3 + A_4 - A_5 + A_6$.

A. 0 B. 2

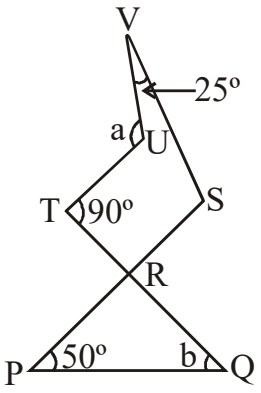
C. 1 D. –3

18. The value of $\sqrt{1+2008\sqrt{1+2009\sqrt{1+2010\sqrt{1+2011.2013}}}}$ is_____

A. 2009 B. 2010

C. 2011 D. 2013

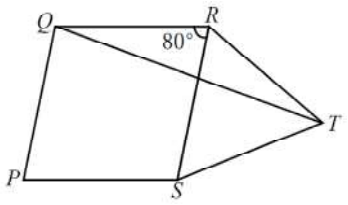
19. In the given figure (not drawn to scale), $TU \parallel SR$ and $TR \parallel SV$, then find $\angle a$ and $\angle b$.



A. $a = 115°, b = 40°$ B. $a = 120°, b = 65°$

C. $a = 115°, b = 50°$ D. $a = 105°, b = 40°$

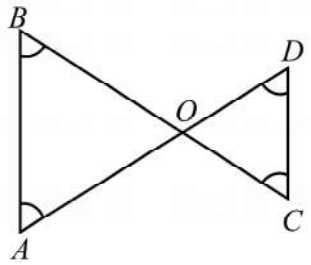
20. $PQRS$ is a rhombus and SRT is an equilateral triangle. If $\angle QRS = 80^\circ$, then $\angle QTR =$



A. 40° B. 20°

C. 30° D. 50°

21. In the given figure, $\angle B < \angle A$ and $\angle C < \angle D$.



Then which of the following statements is true regarding the relationship between AD and BC?

A. $AD = BC$ B. $AD < BC$

C. $AD > BC$ D. Nothing can be said

22. Each edge of an equilateral triangle is 'a' cm. A cone is formed by joining any two sides of the triangle. What is the volume (in cm^3) of the cone?

A. $\frac{a^2}{24\pi^3}\sqrt{4-\pi^2}$ B. $\frac{a^3}{24\pi^2}\sqrt{4\pi^2-1}$

C. $\frac{a^3}{8\pi^2}\pi^2\sqrt{1-4\pi^2}$ D. $\frac{a^3}{\sqrt{3}}\pi^2\left(1-\frac{2}{\pi}\right)$

23. Let S_1 be a square of side 'a'. Another square S_2 is formed by joining the mid-points of the sides of S_1. The same process is applied to S_2 to form yet another square S_3, and so on. If $A_1, A_2, A_3, \ldots$ be the areas and $P_1, P_2, P_3, \ldots..$ be the perimeters of $S_1, S_2, S_3, \ldots$, respectively, then the ratio $\frac{P_1 + P_2 + P_3 + \ldots}{A_1 + A_2 + A_3 + \ldots} =$

A. $\frac{2(1+\sqrt{2})}{a}$ B. $\frac{2(2-\sqrt{2})}{a}$

C. $\frac{2(2+\sqrt{2})}{a}$ D. $\frac{2(1+2\sqrt{2})}{a}$

24. If $2^x = 4^y = 8^z$ and $\left(\frac{1}{2x}+\frac{1}{4y}+\frac{1}{6z}\right)=\frac{24}{7}$, then the value of z is

A. $\frac{7}{16}$ B. $\frac{7}{32}$

C. $\frac{7}{48}$ D. $\frac{7}{64}$

25. Select the correct match.

Let f $(x) = \frac{(x-2)(x-4)}{x}$

Column I	Column II
A. f(x) is a polynomial	As (x . 2), (x . 4), x are polynomials
B. f(x) is an equation	As it can be written as $ax^2 + bx + c$
C. f(x) is a rational number	As it is of the form $\frac{p}{q}, q \neq 0$
D. f(x) is not a polynomial	As the exponents of x are not whole numbers.

SECTION 3 (Maximum Marks: 15)

- This section contains Q.26 to Q. 30.
- Each question has **FOUR** options 'A', 'B', 'C' and 'D'. **ONLY ONE** of these four options is correct
- For each question, marks will be awarded in one of the following categories:

Full Marks : +3 If only the bubble corresponding to the correct option is darkened

Zero Marks : 0 If none of the bubbles is darkened

Negative Marks : –1 In all other cases

26. *a, b, c* are three sets of values of x :

a : 2, 3, 7, 1, 3, 2, 3

b : 7, 5, 9, 12, 5, 3, 8

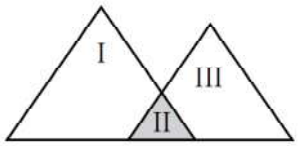
c : 4, 4, 11, 7, 2, 3, 4

Which one of the following statements is correct?

A. Mean of *a* = Mode of *c* B. Mean of *c* = Median of *c*

C. Median of *b* = Mode of *a* D. Mean, Median and Mode of '*a*' are equal

27. Consider the figure below.



The ratio of the area of I to II is 8 : 1. The area of III is $1\frac{2}{3}$ as much as the area of II. If the difference between the area of I and II is 252 cm^2, then

(P) Area of I

(Q) Area of II + III

	P	Q
A.	96 cm^2	288 cm^2
B.	288 cm^2	96 cm^2
C.	188 cm^2	86 cm^2
D.	86 cm^2	188 cm^2

28. Match the columns.

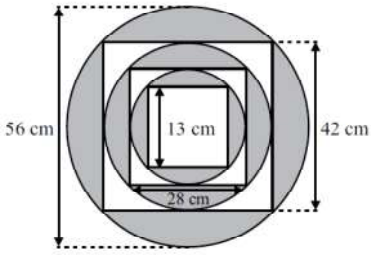
If $\sqrt{\frac{6+2\sqrt{3}}{33-19\sqrt{3}}} = a + b\sqrt{3}$; $a, b > 0$ then

Column I	Column II
(i) $a + b$	a. $\left(\frac{52}{3}\right)^2$
(ii) $(a + b)^2 - 4ab$	b. 8
(iii) $\left(a+\frac{1}{a}\right)^2\left(b+\frac{1}{b}\right)^2$	c. 4
(iv) $((a)^3(b).^{-3})^{-1}$	d. $\left(\frac{3}{5}\right)^3$

A. (i) – a, (ii) – c, (iii) – d, (iv) – b B. (i) – c, (ii) – b, (iii) – a, (iv) – d

C. (i) – d, (ii) – a, (iii) – b, (iv) – d D. (i) – b, (ii) – c, (iii) – a, (iv) – d

29. The given figure, not drawn to scale, is made up of 3 circles and 3 squares. Find the total area of the shaded parts. (Take $\pi = \frac{22}{7}$)



A. 1500 cm^2 B. 1680 cm^2

C. 1749 cm^2 D. 1149 cm^2

30. State True or False and select the correct option.

P. In a ΔABC in which AB = AC, the altitude AD bisects BC.

Q. The sum of any two sides of a triangle is greater than twice the median drawn to the third side.

R. If D is the mid-point of the hypotenuse AC of a right ΔABC, then BD = AC.

S. Perimeter of a triangle is equal to the sum of its three medians.

T. If the altitudes AD, BE and CF of ΔABC are equal, then ΔABC is equilateral.

	P	Q	R	S	T
A.	True	True	False	False	True
B.	True	False	True	False	True
C.	False	True	False	True	False
D.	True	True	False	True	True

PART 'B' (SCIENCE)

SECTION 1 (Maximum Marks: 15)

- This section contains Q.1 to Q. 15.
- Each question has **FOUR** options 'A', 'B', 'C' and 'D'. **ONLY ONE** of these four options is correct
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1. A ball is thrown up with a certain velocity. It attains a height of 40 m and comes back to the thrower. Then the :

A. Total distance covered by it, is 40 m
B. Total displacement covered by it, is 80 m
C. Total displacement is zero
D. Total distance covered by it, is zero

2. A stationary ball weighing 0.25 kg acquires a speed of 10 m/s when hit by a hockey stick. The impulse imparted to the ball is :

A. 0.25 N × s
B. 2.5 N × s
C. 2 N × s
D. 0.5 N × s

3. An artificial satellite orbiting the earth does not fall down because the earth's attraction :

A. Is balanced by the attraction of the moon
B. Produces the necessary acceleration for its motion in a curved path
C. Vanishes at such distance
D. Is balanced by the various drag produced by the atmosphere

4. The relative density of a solid is 0.6. It floats in water with :

A. Whole of its volume inside water
B. 60% volume inside water
C. 60% volume outside water
D. 30% volume inside water

5. Energy is not carried by :

A. Transverse progressive waves
B. Longitudinal progressive waves
C. Stationary waves
D. Electromagnetic waves

6. Sulphur di-oxide gas and ammonia gas were mixed in different proportions. The pair of gases containing same number of molecules at NTP is _____.

A. 1120 cm^3 of SO_2 + 0.85 g of ammonia
B. 0.25g mole of SO_2 + 2240 cm^3 of ammonia
C. 1680 cm^3 of SO_2 +1.7 g of ammonia
D. 0.25 g mole of SO_2 + 0.85 g of ammonia

7. Which of the following contains the same number of atoms as 13.5 grams of aluminium ?

A. 20 g of calcium
B. 10 g of magnesium
C. 20 g of potassium
D. 10 of sodium

8. The average atomic mass of an element X is 80u. The percent of isotopes $^{79}_{35}X$ and $^{82}_{35}X$ in the sample is :

A. 90.99 and 9.01
B. 80.8 and 19.2
C. 66.67 and 33.33
D. 50 and 50

9. Melting point of a substance is 10°C. What does this mean ?

A. The substance is a liquid at 10°C.
B. The substance is a solid at 10°C.
C. There is an equilibrium between solid phase and liquid phase at 10°C.
D. The substance is 50% solid and 50% liquid at 10°C.

10. Cheese is a colloidal system of :

A. Gas in solid
B. Gas in liquid
C. Liquid in gas
D. Liquid in solid

11. Why are capsicums and tomatoes red/yellow in colour ?

A. They obtain that colour upon ripening.
B. They are hybrids.
C. They contain chromoplasts, which impart them colour.
D. They have choloroplasts, which imparts them colour.

12. Where is ciliated columnar epithelium located ?

A. In the oesophagus and the lining of mouth
B. In the kidney tubules
C. In the upper respiratory tract
D. In the lining of lungs

13. What is the correct identification of the following specimen ?

A. Moss
B. Agaricus
C. Spirogyra
D. Fern

14. Four patients have been diagnosed with four different diseases as given below :

(i) Patient A : Tuberculosis (ii) Patient B : Smallpox

(iii) Patient C : Influenza (iv) Patient D : Pneumonia

Who among them may get a chronic disease ?

A. Patient A B. Patient B

C. Patient C D. Patient D

15. What is the crossing between two species of the same genus called ?

A. Intravarietal hybridisation B. Intergeneric hybridisation

C. Intrageneric hybridisation D. Intervarietal hybridisation

SECTION 2 (Maximum Marks: 20)

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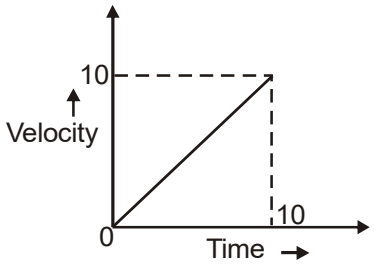
16. Two bodies of masses 1 kg and 4 kg possess equal momentum. The ratio of their K.E. is :

A. 4 : 1 B. 1 : 4

C. 2 : 1 D. 1 : 2

17. What would be the value of average velocity for the duration 0-10s in the graph shown below ?



A. 4m/s B. 5m/s

C. 3m/s D. 6m/s

18. Two point masses 1 kg each, attract one another with a force of 10^{-11} N. What is the distance between the two point masses is ($G=6.67 \times 10^{-11}$ MKS)

A. $2\times\sqrt{6.67}$ B. $3\times\sqrt{6.67}$

C. $4\times\sqrt{6.67}$ D. $\sqrt{6.67}$

19. A force of 20 N displaces an object through 10 cm and does one joule work in this process. The angle between the force and displacement is :

A. 0º B. 30º

C. 45º D. 60º

20. State which of the following is not likely to be an element.

I. On heating gives off a gas and leaves a residue.

II. Burns in air to form carbon dioxide and water.

III. Changes into solid at 273 K and to a gas at 373 K.

A. I B. II and III

C. I and III D. I, II, III

21. The composition of three atomic particles is given :

	X	Y	Z
Protons	8	7	7
Neutrons	8	9	9
Electrons	8	8	7

What is the relation between X and Y and between Y and Z ?

A. X and Y are isotopes, Y and Z are isotopes

B. X and Y are isobars, Z is an ion of Y

C. X and Y are isobars, Y is an ion of Z

D. No relation between X and Y, Y and Z are same

22. Chemical formulae of few compounds are given.

(i) $Zn_3(PO_4)_2$ (ii) SFe

(iii) AlN_3 (iv) $Ca(HCO_3)_2$

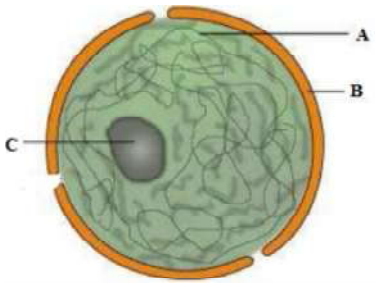
(v) K_2SO_4

The wrong chemical formulae are

A. (ii) and (iii) B. (i), (iv) and (v)

C. (i) and (iv) D. (i), (ii) and (iv)

23. Observe the above figure of nucleus and choose the incorrect answer.



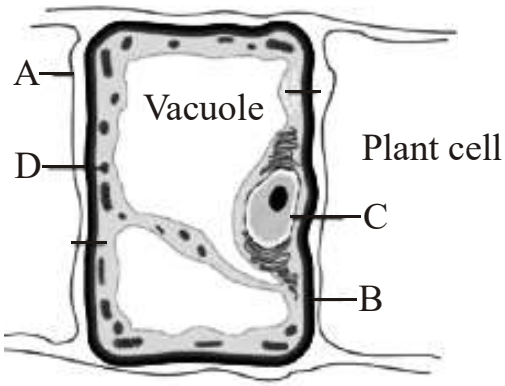
A. A carry units for inheritance.

B. B is selectively permeable.

C. C is the control center of the activities of the cell.

D. A can be seen only when cell divides.

24. Refer to the above diagram and choose the incorrect option.



A. A is made up of cellulose.

B. C performs photosynthesis

C. C performs photosynthesis.

D. D are absent in animal cells

25. Read the following statements :

I. It forms a thick, tough barrier and protects the underlying tissues in the skin.

II. When it is present in sense organs, it contains receptor cells.

III. It also helps in absorption of nutrients.

IV. When it is present in glands, it helps in secretion.

Which one of the following represents the above mentioned characteristics ?

A. Epithelial tissue

B. Connective tissue

C. Muscular tissue

D. Nerve tissue

SECTION 3 (Maximum Marks: 15)

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26. A train passes over a 400 m long bridge. If the speed of the train is 30 m/s and the train takes 20 s to cross the bridge, then the length of the train is

A. 400 m B. 600 m

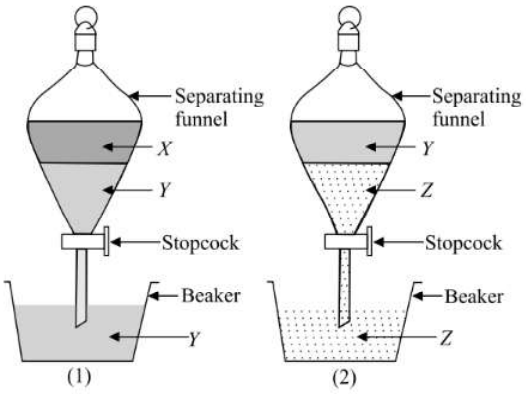
C. 800 m D. 200 m

27. What is the density of mixture of 1.5 m^3 of water, 0.5 m^3 of alcohol of density 800 kg/m^3 and 1.0 m^3 juice of density 1100 kg/m^3?

A. 900 kg/m^3 B. 800 kg/m^3

C. 1000 kg/m^3 D. 1100 kg/m^3

28. Observe the given figures carefully.



Which of the following observations are correct?

(i) If X and Z are immiscible liquids then Z will be collected in the beaker.

(ii) Among the three liquids, Y is lightest.

(iii) In experimental set up (1), X and Y are miscible liquids while in (2), Y and Z are immiscible liquids.

(iv) If X, Y and Z all are immiscible liquids then order of density is X < Y < Z.

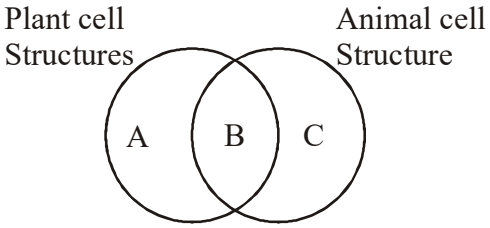
A. (i) and (iv) only B. (i), (iii) and (iv) only

C. (i), (ii) and (iii) only D. (ii) and (iii) only

29. Fill the missing data in the given table. (Atomic mass of Ca = 40 u, H = 1 u, O = 16 u, Na = 23 u, Cl = 35.5 u, N = 14 u)

	(i)	(ii)	(iii)	(iv)
A.	36.14×10^{23}	48.184×10^{23}	146.25	3.012×10^{23}
B	18.07×10^{23}	2	146.25	3.012×10^{23}
C.	18.07×10^{23}	2	46	2.45×10^{23}
D.	1	4	23	92

30. Refer to the Venn diagram given above and choose the incorrect answer about A, B and C.



A. Set A consists of a protection providing structure.

B. Set C does not contain any structure with green pigments.

C. Set B includes control center of the cell.

D. Set B does not consist of structures that define shape of the cell

Space for rough work

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