CLASS

10

BVPY QUESTION PAPER – STAGE 1

December 17, 2020

Part A – Mathematics (Q1 to Q30)

Part B – Science (Q1 to Q30)

Maximum Marks: 60 **Duration : 60 minutes**

Instructions for Students :

1. Each question carries one mark.
2. This paper consists two parts i.e. Part 'A' (Mathematics) Q.1 to 30, Part 'B'(Science) Q1 to 30.
3. There is no negative marking .

PART 'A' (MATHEMATICS)

1. If $2^{2008} - 2^{2007} - 2^{2006} + 2^{2005} = k.\ 2^{2005}$ then the value of k is equal to :

   A. 2 B. 3

   C. 4 D. 5

2. If $a^2 + 2b = 7$, $b^2 + 4c = -7$ and $c^2 + 6a = -14$, then the value of $(a^2 + b^2 + c^2)$ is :

   A. 14 B. 25

   C. 36 D. 47

3. The slant height of a cone is increased by P%. If radius remains same, the curved surface area is increased by :

   A. P % B. P^2 %

   C. $2P$ % D. None of these

4. If a cone is cut into two parts by a horizontal plane passing through the mid-point of its axis, the ratio of the volumes of the upper part and the cone is :

   A. 1 : 2 B. 1 : 4

   C. 1 : 6 D. 1 : 8

5. A bag contains 20 balls out of which x are black. If 10 more black balls are put in the box, the probability of drawing a black ball is double of what it was before. The value of x is :

   A. 0 B. 5

   C. 10 D. 40

6. If the roots of the equation $px^2 + qx + r = 0$ are in the ratio ℓ : m then :

   A. $(\ell + m)^2 pq = \ell mr^2$ B. $(\ell + m)^2 pr = \ell mq$

   C. $(\ell + m)^2 pr = \ell mq^2$ D. None of these

7. The sum of the third and seventh terms of an A.P. is 6 and their product is 8, then common difference is :

   A. ± 1 B. ± 2

   C. $\pm \frac{1}{2}$ D. $\pm \frac{1}{4}$

8. What is the remainder when $74^{13} - 41^{13} + 75^{13} - 42^{13}$ is divided by 66 ?

   A. 2 B. 64

   C. 1 D. 0

9. The *LCM* of two numbers is 864 and their *HCF* is 144. If one of the numbers is 288, then the other number is :

A. 576 B. 1296

C. 432 D. 144

10. If four numbers in A. P. are such that their sum is 50 and the greatest number is 4 times the least, then the numbers are :

A. 5, 10, 15, 20 B. 4, 10, 16, 22

C. 3, 7, 11, 15 D. None of these

11. If S_1 is the sum of an arithmetic progression of 'n' odd number of terms and S_2 the sum of the terms of the series in odd places, then $\frac{S_1}{S_2} =$

A. $\frac{2n}{n+1}$ B. $\frac{n}{n+1}$

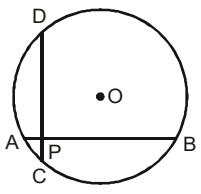
C. $\frac{n+1}{2n}$ D. $\frac{n+1}{n}$

12. The sum $1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\frac{1}{5}-\frac{1}{6}+\ldots\ldots\ldots\ldots-\frac{1}{2012}+\frac{1}{2013}$ equals :

A. $\frac{1}{1006}+\frac{1}{1007}+\frac{1}{1008}+\ldots\ldots\ldots\ldots+\frac{1}{2013}$ B. $\frac{1}{1007}+\frac{1}{1008}+\frac{1}{1009}+\ldots\ldots\ldots\ldots+\frac{1}{2013}$

C. $\frac{1}{1006}+\frac{1}{1007}+\frac{1}{1008}+\ldots\ldots\ldots\ldots+\frac{1}{2012}$ D. $\frac{1}{1007}+\frac{1}{1008}+\frac{1}{1009}+\ldots\ldots\ldots\ldots+\frac{1}{2012}$

13. In the circle with centre 'O' as shown, chord AB and CD intersect at P and are perpendicular to each other. If $AP = 4$, $PB = 6$ and $PC = 2$, then the area of the circle is :



A. 45π B. 49π

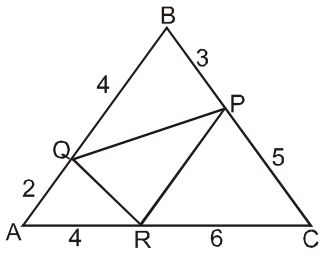
C. 50π D. $41\pi 4$

14. Tangents to a circle at points P and Q on the circle intersect at a point R. If $PQ = 6$ and $PR = 5$ then the radius of the circle is :

A. $\frac{13}{3}$ B. 4

C. $\frac{15}{4}$ D. $\frac{16}{5}$

15. In the adjoining figure $AQ = 2$, $QB = 4$, $BP = 3$, $PC = 5$, $CR = 6$ and $RA = 4$. Find the area of triangle PQR.



A. 4.8 B. 5.2

C. 5.8 D. 6.2

16. The average of 9 numbers is 18. If the average of first five numbers is 19 and the average of last 5 numbers is 17, find the 5th number.

A. 16 B. 20

C. 18 D. 22

17. What is the ratio in which the x-axis divides the line segment joining the points $(3, -4)$ and $(2, 6)$ internally ?

A. 2 : 3 B. 3 : 2

C. 4 : 3 D. 3 : 4

18. The present age difference between father and son is 14 years. The ratio of their ages will be 4 : 3 after 11 years. How old is son now ?

A. 25 years B. 31 years

C. 30 years D. 28 years

19. If α, β be the zeros of the polynomial $2x^2 + 5x + k$ such that $\alpha^2 + \beta^2 + \alpha\beta = \frac{21}{4}$, then $k = ?$

A. 3 B. – 3

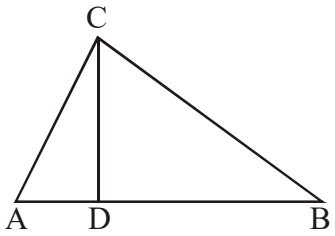
C. 2 D. – 2

20. The difference between the two roots of a quadratic equation is 2 and the difference between the cubes of the roots is 98, then which of the following is that quadratic equation ?

A. $x^2 - 8x + 15 = 0$ B. $x^2 + 8x - 15 = 0$

C. $x^2 + 5x + 15 = 0$ D. $x^2 - 5x - 15 = 0$

21. In the following figure $\angle ACB = 90°$ and $CD \perp AB$. If $AD = 4\ cm$ and $BD = 9\ cm$ then the ratio $BC : AC$ is



A. 3 : 2 B. 2 : 3

C. 16 : 81 D. 81 : 16

22. A cone and a hemisphere have equal bases and equal volumes the ratio of the heights of cone and hemisphere is

A. $1 : \sqrt{4}$ B. 2 : 1

C. 4 : 1 D. $\sqrt{2} : 1$

23. The probability for a randomly selected number out of 1, 2, 3, 4, ..., 25 to be a prime number is –

A. $\frac{2}{25}$ B. $\frac{23}{25}$

C. $\frac{10}{25}$ D. $\frac{9}{25}$

24. If $(x+1)(x+2)(x+3)(x+k)+1$ is a perfect square, then the value of k is

A. 4 B. 5

C. 6 D. 7

25. $x^{831} + y^{831}$ is always divisible by

A. $x - y$ B. $x^2 + y^2$

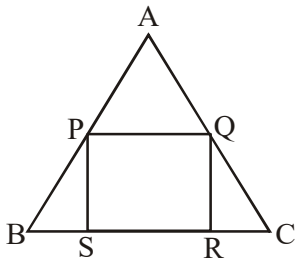
C. $x + y$ D. None of these

26. What is the first degree expression to be subtracted from $x^6 + 8x^4 + 2x^3 + 16x^2 + 4x + 5$ in order to make it a perfect square ?

A. $-4x - 4$ B. $4x + 4$

C. $4x - 4$ D. $-4x + 4$

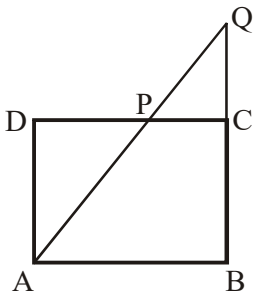
27. In the figure given below, ABC is an equilateral triangle and $PQRS$ is a square of side 6 cm. By how many sq. cm is the area of the triangle more than that of the square ?



A. $\frac{21}{\sqrt{3}}$ B. 21

C. $21\sqrt{3}$ D. 63

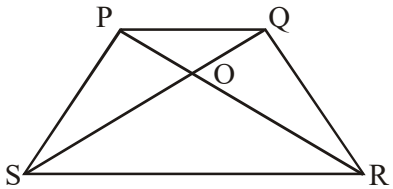
28. In the above figure (not to scale) $ABCD$ is a rectangle, BC = 24 cm, DP = 10 cm and CD = 15 cm. Then AQ and CQ respectively are



A. 39 cm, 13 cm B. 13 cm, 12 cm

C. 25 cm, 13 cm D. 39 cm, 12 cm

29. In the trapezium $PQRS$, PQ is parallel to RS and the ratio of the areas of the triangle POQ to triangle ROS is 225 : 900. Then SR = ?



A. 30 PQ B. 25 PQ

C. 2 PQ D. PQ

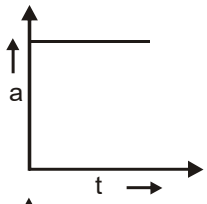
30. Side of a square $PQRS$ is 4 cm long. $\overline{PR}$ is produced to the point M such that $PR = 2RM$. Find SM.

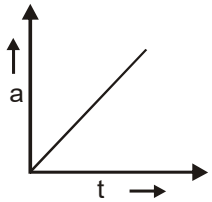
A. $\sqrt{10}\,cm$ B. $\sqrt{5}\,cm$

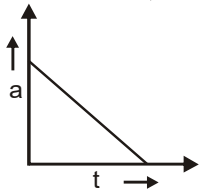
C. $2\sqrt{5}\,cm$ D. $2\sqrt{10}\,cm$

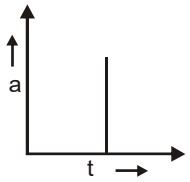
PART 'B' (SCIENCE)

1. Which of the acceleration - time graph is not possible?

A. 

B. 

C. 

D. 

2. Two bodies A and B of mass 500 g and 200 g respectively are dropped near the earth's surface. Let the acceleration of A and B be a_A and a_B respectively, then :

A. $a_A = a_B$ B. $a_A > a_B$

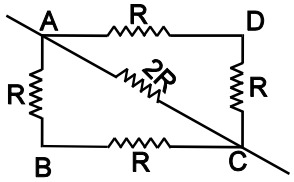
C. $a_A < a_B$ D. $a_A \neq a_B$

3. When sound waves travelling in air enter into the medium of water, the quantity which remains unchanged is :

A. Wavelength B. Velocity

C. Frequency D. None

4. In the given circuit, the effective resistance between points A and C will be :



A. $\frac{3}{2}R$ B. $6R$

C. $\frac{2}{3}R$ D. $3R$

5. The correct relation between heat produce (H) and electric current I flowing is :

A. $H \propto I$ B. $H \propto \frac{1}{I}$

C. $H \propto I^2$ D. $H \propto \frac{1}{I^2}$

6. Which of the following statement is not correct about two parallel conductors carrying equal currents in the same direction ?

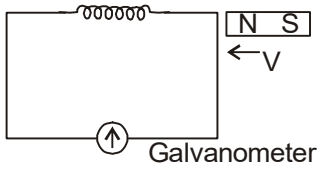
A. Each of the conductors will experience a force.

B. The two conductors will repel each other.

C. There are concentric lines of force around each conductor.

D. Each of the conductors will move if not prevented from doing so.

7. In Faraday's experiment (figure below), choose the wrong statement :



A. On increasing the speed of magnet, deflection in galvanometer increases.

B. On reversing the direction of motion of magnet, deflection in galvanometer gets reversed

C. On increasing the number of turns in coil, current decreases

D. On keeping the magnet fixed, but moving the coil, galvanometer registers a current

8. When a beta particle is given out, the atomic number of the parent atom :

A. Increases by unity

B. Decreases by unity

C. Remains the same

D. Is halved

9. Choose the correct relation between u, v and R :

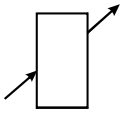
A. $R = \frac{2uv}{u+v}$

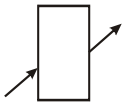
B. $R = \frac{2}{u+v}$

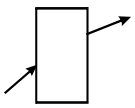
C. $R = \frac{2(u+v)}{(uv)}$

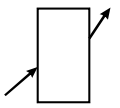
D. None of these

10. Four students showed the following traces of the path of a ray light passing through a rectangular glass slab. The trace most likely to be correct is that of student :

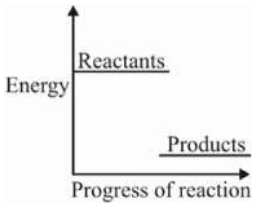
A. 

B. 

C. 

D. 

11. The given diagram shows the energy levels of the reactants and products for a particular reaction :
Which of the following processes can be related to the given diagram?



A. Ethyne gas burns in oxygen to form carbon dioxide and water along with evolution of heat.
B. When solid mercury (II) oxide is heated liquid mercury and oxygen gas are produced.
C. Hydrogen gas combines with chlorine gas in the presence of light to form hydrogen chloride gas.
D. Potassium chlorate decomposes in presence of heat to form potassium chloride and oxygen.

12. Baking powder is a mixture of *X* and a mild edible acid such as *Y*. When it is heated, *Z* is produced which makes bread and cake soft and spongy. *X*, *Y* and *Z* are respectively.
A. Sodium hydrogen carbonate, tartaric acid, CO_2
B. Sodium carbonate, acetic acid, CO_2
C. Sodium hydroxide, acetic acid, H_2
D. Sodium chloride, oxalic acid, H_2

13. Read the given statements carefully and state (T) for true and (F) for false ones.
I. Metals of low reactivity can be extracted directly by the electrolysis of their molten ores.
II. Prier to reduction, metal sulphides and carbonates must be converted to metal oxides.
III. Metals of high reactivity can be extracted by electrolytic oxidation.
IV. Thermite reaction is a displacement reaction and is highly exothermic.

A.	I	II	III	IV
	F	T	F	T
B.	I	II	III	IV
	F	T	T	F
C.	I	II	III	IV
	T	T	F	F
D.	I	II	III	IV
	T	F	F	T

14. An ester of molecular formula $C_4H_8O_2$ was produced by the reaction of an alcohol with a carboxylic acid.

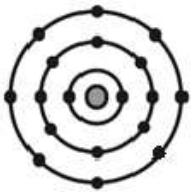
Alcohols	Acids
1. Methanol	Propanoic acid
2. Ethanol	Ethanoic acid
3. Propanol	Methanoic acid

Which of the following could be the alcohol and the acid?

A. 2 B. 1 and 2

C. 1 and 3 D. 1, 2 and 3

15. Element *M* forms an ion, M^{2+} and element *X* forms an ion, X^{2-}. The electronic arrangements of these ions are shown as



M^{2+} ion

X^{2-} ion

Which of the following statements about the elements *M* and *X* is/are incorrect?

I. *M* is in group 2 and period 4 of the periodic table.

II. *M* is a non-metal and *X* is a metal.

III. *X* is in group 15 and period 2 of the periodic table.

IV. *M* and *X* form *MX* type compound.

V. On moving from *M* towards *X* in the periodic table, electronegativity decreases.

A. II, III and V B. I and IV

C. Only II D. II and III

16. An element *M* belongs to the group 1 and period 3 of the modern periodic table. Out of the following statements, which is true about '*M*'?

A. It forms an acidic oxide having formula M_2O_3.

B. It is a non-metal.

C. It is highly electropositive in nature.

D. It has a valency of three.

17. Which of the followig substance is added to denatured ethanol?

A. Methanol
B. Benzene
C. Water
D. Poison

18. Al_2O_3 reacts with –

A. Only acids
B. Only alkalies
C. With both acids and alkalies
D. Do not react with acids and alkalies both

19. Which of the following students have the maximum number of atoms ?

Raman : 56 *g* of Fe;

Vijay : 18.9 *g* of HNO_3

Niharika : 1 *mol* of CO_2;

Abhinav : 8 *g* of He

A. Raman
B. Niharika
C. Vijay
D. Abhinav

20. What kind of a colloidal solution is an emulsion?

A. Solid dispersed in solid
B. Liquid dispersed in liquid
C. Gas dispersed in liquid
D. Liquid dispersed in solid

21. When does chromosome crossing over occur?

A. Leptotene
B. Zygotene
C. Pachytene
D. Diakinesis

22. Several diseases can lead to someone producing large amounts of dilute urine. What could cause one of them?

A. Absence of antidiuretic hormone (ADH / vasopressin)
B. Blood loss (haemorrhage)
C. Low blood glucose levels
D. Damage to the large intestine

23. The colour of snapdragon flowers is genetically controlled as shown:

Genotype	Phenotype
rr	white
Rr	Pink
RR	Red

Parent plants are crossed to produce many offspring. None of these firstgeneration offspring have white flowers. However, when these offspring are crossed, some of the second generation have white flowers. What colour could each of the parent flowers be? Choose from options in the table:

Cross	Parent 1	Parent 2
i	White	Red
ii	Pink	Pink
iii	Pink	Red
Iv	Pink	White

A. i B. ii

C. iii D. iv

24. Water travels from plant roots to plant shoots. How is this achieved?

A. Water is actively transported up the phloem.

B. Water is actively transported up the xylem.

C. Water is pulled by transpiration up the phloem.

D. Water is pulled by transpiration up the xylem.

25. If the epiglottis does not function correctly, what might happen :

A. Peristalsis may stop B. Acid reflux will damage the Oesophagous

C. One might choke D. Swallowing will be difficult or impossible

26. Fat molecules are a rich source of energy for the body. The first step in the digestion of fat is to dissolve it into the watery content of the intestinal cavity . Which chemical substance aids fat to dissolve in water?

A. Insulin B. Glucagon

C. Secretion D. Bile

27. Waste products of plants like tannins and raphides are stored in :

A. Sclerenchyma B. Parenchyma

C. Collenchyma D. Xylem

28. What is wrong with this pyramid of numbers?

Sparrowhawk 

Thrush 

Clover 

Snail 

A. Hawk don't eat thrushes
B. He clover should be at the bottom
C. Snails don't eat clover
D. Hawk should be at the bottom

29. What is the difference between a reptile and an amphibian

A. An amphibian has a back bone and reptiles do not.
B. An amphibian has adaptations for life on land and water and reptiles do not.
C. A reptile has a back bone and amphibians do not.
D. A reptile has adaptations for life on land and water and amphibians do not.

30. Which class of animals has the following list of characteristics?

Cold Blooded

- Lays Eggs
- Bodies are covered with dry scales

A. Reptiles
B. Fish
C. Amphibians
D. Mammals

Space for rough work