

FIITJEE - INTERNAL PHASE TEST**PHYSICS, CHEMISTRY & MATHEMATICS****CODE: 100859****Time Allotted: 3 Hours****Maximum Marks: 255**

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

INSTRUCTIONS

Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.

A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains Three Parts.
3. **SECTION-I** is Physics, **SECTION -II** is Chemistry and **SECTION -III** is Mathematics.
4. Each **Section** is further divided into **Two Parts: Part-A & B** in the OMR.
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

B. Filling of OMR Sheet

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with **Blue/Black Ball Point Pen** for each character of your Enrolment No. and write in ink your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.

C. Marking Scheme For All Two Parts.

- (i) **PART-A (01-07)** contains 7 Multiple Choice Questions which have **One or More Correct** answer. For each question in the group **Q. 01 – 07 of PART – A** you will be awarded
Full Marks: +4 If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
Partial Marks: +1 For darkening a bubble corresponding to **each correct option**, provided NO incorrect option is darkened.
Zero Marks: 0 If none of the bubbles is darkened.
Negative Marks: -1 In all other cases.
 For example, if **(A), (C) and (D)** are all the correct options for a question, darkening all these three will result in **+4 marks**; darkening only **(A) and (D)** will result in **+2 marks**; and darkening **(A) and (B)** will result in **-1 mark**, as a wrong option is also darkened.
- (ii) **Part-A (08-14)** – Contains seven (07) multiple choice questions which have **ONLY ONE CORRECT** answer. Each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer
- (iii) **Part-A (15-18)** - This section contains Two paragraphs. Based on each table, there are Two multiple choice questions. Each question has **only one correct** answer and carries **+3 marks** for the correct answer. **There is no negative marking.**
- (iv) **Part-A (19-20)** – This section contains Two (02) List-Match Sets, each List-Match set has One (01) Multiple Choice Questions. Each List-Match set has two lists: List-I and List-II. FOUR options are given in each Multiple Choice Question based On List-I and List-II and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question. Each question carries **+3 Marks** for correct combination chosen and **-1 mark** for wrong options chosen.
- (v) **Part-B (01-06)** contains six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals to **Two decimal places** (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+3 marks** for correct answer. **There is no negative marking.**

Name of the Candidate : _____

Batch : _____ Date of Examination : _____

Enrolment Number : _____

BATCHES – Four Year CRP428 (R & W)_PT-3+4

SECTION – I (PHYSICS)

PART – A

Multiple Correct Choice Type

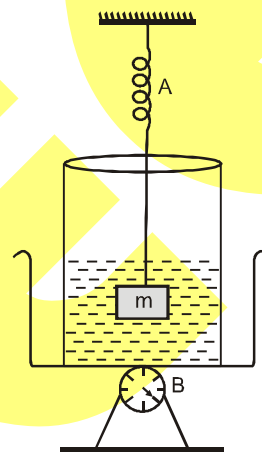
This section contains 7 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE THAN ONE are correct.

1. A ball of mass 2 kg dropped from a height of 20 cm. If ball rebounds to the height of 14 cm then ($g = 10 \text{ m/s}^2$)
- (A) loss in the energy of ball is 30%
 - (B) loss in the energy of ball is 40%
 - (C) Change in total mechanical energy of ball is 1.2 J
 - (D) the momentum of the ball at topmost point is 0

2. The spring balance A reads 2 kg with a block m suspended from it, a balance B reads 5 kg when a beaker with liquid is put on the pan of balance. The two balances are now so arranged that the hanging mass is inside the liquid in the beaker as shown.

In this situation

- (A) the balance B will read more than 5 kg
- (B) the balance A will read less than 2 kg
- (C) the balance A will read less than 5 kg
- (D) the balance A will read more than 2 kg



3. A bullet of mass 10 g, travelling horizontally with a velocity of 150 m/s strikes a stationary wooden block and comes to rest in 0.03 s.
- (A) The magnitude of force exerted by wooden block on the bullet is 150 N.
 - (B) The distance the bullet penetrates in the block is 4.5 m
 - (C) The magnitude of force exerted by wooden block on the bullet is 50 N.
 - (D) The distance the bullet penetrates in the block is 2.25 m

4. When a body is weighed in a liquid the loss in its weight is equal to :
- (A) Weight of liquid displaced by the body
 - (B) Twice the weight of water displaced by the body
 - (C) The difference in weights of body in air and liquid
 - (D) The upthrust of liquid on the body.

5. Which of the following are the properties of ultrasonic waves?
- (A) high power
 - (B) good directionality
 - (C) longer wavelength
 - (D) lower frequency

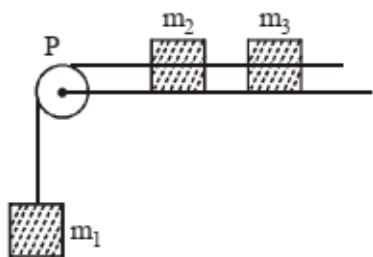
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6. When a force retards the motion of a body
 (A) its kinetic energy always decreases.
 (B) the work done by the force is negative.
 (C) the forces acts opposite to the displacement.
 (D) its kinetic energy is negative.
7. When wave travels from one medium to another, which is/are quantity that changes?
 (A) Frequency (B) Wavelength
 (C) Velocity (D) None of these

Single Correct Choice Type

This section contains 7 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE option is correct.

8. A projectile can have the same range R for two angles of projection. If t_1 and t_2 be the times of flight in two cases, then what is the product of two times of flight?
 (A) $t_1 t_2 \propto R$ (B) $t_1 t_2 \propto R^2$
 (C) $t_1 t_2 \propto 1/R$ (D) $t_1 t_2 \propto 1/R^2$
9. A system consists of three masses m_1 , m_2 and m_3 connected by a string passing over a pulley P . The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (the coefficient of friction = μ). The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is : (Assume $m_1 = m_2 = m_3 = m$)



- (A) $\frac{g(1-g\mu)}{g}$ (B) $\frac{2g\mu}{3}$
 (C) $\frac{g(1-2\mu)3}{3}$ (D) $\frac{g(1-2\mu)}{2}$
10. A spring with force constant k is initially stretched by x_1 . If it is further stretched by x_2 , then the increase in its potential energy is
 (A) $\frac{1}{2}k(x_2 - x_1)^2$ (B) $\frac{1}{2}kx_2(x_2 + 2x_1)$
 (C) $\frac{1}{2}kx_1^2 - \frac{1}{2}kx_2^2$ (D) $\frac{1}{2}k(x_1 + x_2)^2$

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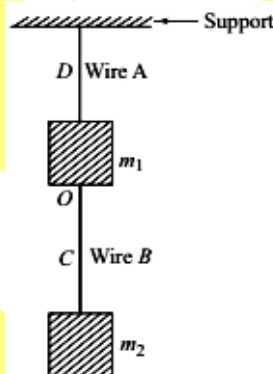
11. A mass of m kg moving with a speed of 1.5 m/s on a horizontal smooth surface, collides with a nearly weightless spring of force constant $k = 50$ N/m. If the maximum compression of the spring is 0.15 m, the value of mass m is
 (A) 0.5 kg (B) 0.15 kg (C) 0.12 kg (D) 1.5 kg
12. If two persons A and B take 2 seconds and 4 seconds respectively to lift an object to the same height h , then the ratio of their powers is
 (A) 1 : 2 (B) 1 : 1 (C) 2 : 1 (D) 1 : 3
13. The total weight of a piece of wood is 6 kg. In the floating state in water its $\frac{1}{3}$ part remains inside the water. On this floating piece of wood what maximum weight is to be put such that the whole of the piece of wood is to be drowned in the water?
 (A) 15 kg (B) 14 kg (C) 10 kg (D) 12 kg
14. Sound waves are not transmitted to long distances because,
 (A) they are absorbed by the atmosphere
 (B) they have constant frequency
 (C) the height of antenna required, should be very high
 (D) velocity of sound waves is very less

Comprehension Type

This section contains 2 Paragraphs which has two multiple choice questions each. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE option is correct.

Paragraph - I (15-16)

Two blocks of masses $m_1 = 3m$ and $m_2 = 2m$ are suspended from a rigid support by two inextensible uniform wires A and B. Wire A has negligible mass and wire B has a mass $m_3 = m$, as shown in figure. The whole system of blocks, wires and the support have an upward acceleration a .



15. The tension at the midpoint C of wire B is
 (A) $\frac{1}{2}m(g+a)$ (B) $\frac{3}{2}m(g-a)$ (C) $\frac{3}{2}m(g+a)$ (D) $\frac{5}{2}m(g+a)$

Space For Rough Work

16. The tension at point O of wire B is
 (A) $3m(g+a)$ (B) $3m(g-a)$ (C) $2m(g+a)$ (D) $2m(g-a)$

Paragraph –II (17-18)

An observer standing at sea coast observes 48 waves reaching the coast per minute. If the wavelength of the waves is 6 m, find

17. Frequency of the waves
 (A) 0.5 Hz (B) 0.6 Hz (C) 0.7 Hz (D) 0.8 Hz
18. Velocity of the waves
 (A) 3 m/s (B) 3.5 m/s (C) 4.2 m/s (D) 4.8 m/s

Match Type

This section contains Two (02) List-Match Sets, each List-Match set has One (01) Multiple Choice Questions. Each List-Match set has two lists: List-I and List-II. FOUR options are given in each Multiple Choice Question based On List-I and List-II and ONLY ONE of these four options satisfies the condition asked in the Multiple Choice Question.

19. Match the columns–I and II.

Column-I		Column-II	
(A)	Force between any two bodies	(1)	Maximum at the earth's surface
(B)	Acceleration due to gravity	(2)	Always attractive
(C)	Escape velocity	(3)	\sqrt{gR}
(D)	Orbital velocity	(4)	$\sqrt{2} \cdot \sqrt{gR}$

- (A) (A) → (2); (B) → (1); (C) → (3); (D) → (4)
 (B) (A) → (2); (B) → (2); (C) → (4); (D) → (3)
 (C) (A) → (4); (B) → (3); (C) → (2); (D) → (1)
 (D) (A) → (2); (B) → (1); (C) → (4); (D) → (3)

20. Match the columns–I and II.

Column-I		Column-II	
(A)	Mechanical waves	(1)	Disturbance for short time
(B)	Pulse	(2)	Independent of amplitude of vibrations
(C)	Velocity of sound in air	(3)	SONAR
(D)	Tracking of fish in ocean	(4)	Require a material medium

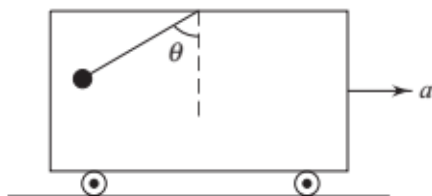
- (A) (A) → (3); (B) → (4); (C) → (1); (D) → (2)
 (B) (A) → (1); (B) → (2); (C) → (3); (D) → (4)
 (C) (A) → (4); (B) → (1); (C) → (2); (D) → (3)
 (D) (A) → (3); (B) → (4); (C) → (2); (D) → (1)

Space For Rough Work

PART – B
Numerical Based

This section contains 6 questions. The answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries +3 marks for correct answer.

1. A pendulum of bob of mass $m = 100$ g is suspended from the ceiling of the compartment of a train. If the train has the acceleration a as shown in figure, the string makes an angle $\theta = 60^\circ$ with the vertical. Find the value of a . (Take $g = 9.8$ m/s²)



2. A block of mass $m = 2$ kg is raised vertically upwards by means of a massless string through a distance of 4 m with a constant acceleration $a = 2.2$ m/s². The work done by tension is $16x$ J. Find the value of x .
3. An electric pump on the ground floor of a building takes 10 minutes to fill a tank of volume 2000 litre with water. If the tank is 40 m above the ground and the efficiency of the pump is 40%, how much electric power is consumed by the pump in filling the tank? Take $g = 10$ m/s².
4. A spring balance reads 10 kg when a bucket of water is suspended from it. What will be the reading of the spring balance when, an iron piece of 7.2 kg suspended from another spring is immersed with half its volume inside water in the bucket? Relative density of iron is 7.2.
5. Ocean wave striking the shore were found to move with a speed of 10 m/s. If the time interval between two consecutive waves be 5 secs and the wavelength is $10n$ metre, then find n .
6. The ratio of wavelength of two ultrasonic waves having frequency 1.5×10^5 Hz and 2.5×10^5 Hz is $\frac{5}{m}$. Find value of m if speed of both wave is same.
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Space For Rough Work

SECTION – II (CHEMISTRY)**PART – A****Multiple Correct Choice Type**

This section contains 7 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE THAN ONE are correct.

- Which of the following have same amount of substance?
(A) 1 mole of oxygen atom (O) (B) 16 g of oxygen (O)
(C) gram atomic mass of O (D) 6.02×10^{23} atoms of O
 - Heat responsible for the interconversion of physical state of matter and not raise the temperature is/are.
(A) Latent heat of fusion (B) latent heat of vapourisation
(C) Heat of Reaction (D) Enthalpy
 - Which of the following statements are correct about Dalton's atomic theory?
(A) All matter, whether an element, a compound or a mixture is made up extremely small particles called atoms.
(B) Atoms of the same elements are not identical in size, shape, mass and properties.
(C) When atoms of different elements combine together to form compounds, they do so in a simple whole number ratio.
(D) Atoms of two different elements may combine in different ratios to form more than one compound.
 - Charge on 1 mole electron is equal to
(A) 96500 C (B) 1 Faraday
(C) $1.6 \times 10^{-19} N_A$ C (D) None of these
 - Which of the following are isoelectronic with argon?
(A) Cl^- (B) S^{2-}
(C) Ca^{2+} (D) Zn^{2+}
 - Which of the following metal(s) were used for the discovery of neutrons (alpha particle were bombarded on to the metals)?
(A) Be (B) B
(C) Au (D) Ag
 - For which species, Bohr's theory does not apply:
(A) H (B) Be
(C) He (D) Li^{2+}
-

Space For Rough Work

Single Correct Choice Type

This section contains 7 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE option is correct.

8. An ion having a mass number 52 has 3 units of positive charge. The number of neutrons in the ion exceeds the number of electrons in it by 7. The atomic number of the element is
(A) 28 (B) 22
(C) 26 (D) 24
9. What is the mass of 12.044×10^{23} number of O_2 molecules?
(A) 8 g (B) 16 g
(C) 32 g (D) 64 g
10. 1.0 g of hydrogen contains 6×10^{23} atoms. The atomic mass of helium is 4. It follows that the number of atoms in 1 g of He is:
(A) $\frac{1}{4} \times 6 \times 10^{23}$ (B) $4 \times 6 \times 10^{23}$ (C) 6×10^{23} (D) 12×10^{23}
11. At STP, 67.2 L of CO_2 contains how many moles of it?
(A) 1 mole (B) 6 moles
(C) 3 moles (D) 2 moles
12. Calculate total number of electrons present in 3.2 g of oxygen gas?
(A) 9.635×10^{23} electrons (B) 6.022×10^{22} electrons
(C) 6.022×10^{23} electrons (D) 3.011×10^{22} electrons
13. What will be the number of chloride ions (Cl^\ominus) in the 222 g of Calcium Chloride?
(A) 6.02×10^{23} (B) 24.08×10^{23}
(C) $3N_A$ (D) 2.8×10^{23}
14. Number of neutrons in 23g sodium metal is
(A) 72.264×10^{23} (B) 6.022×10^{23}
(C) 12 (D) 11
-

Space For Rough Work

Comprehension Type

This section contains 2 Paragraphs which has two multiple choice questions each. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE option is correct.

Paragraph - I (15-16)

The amount of substance whose mass in g is numerically equal to its atomic mass is called gram atomic mass of that substance and just as an same way, amount of substance whose mass in grams is numerically equal to its molecular mass is called gram molecular mass of that substance

15. Gram atomic mass of an atom and gram molecular mass of a molecule will be equal to
 (A) Weight of 1 atom and molecule
 (B) Weight of 1 mole of atom and molecule respectively
 (C) No of atoms and molecules respectively
 (D) Can not be predicted
16. If amount of methane (CH₄) present in a container is equal to its gram molecular mass, then how many grams of carbon will be in container?
 (A) 16 g (B) 8g
 (C) 12 g (D) 1-2 g

Paragraph -II (17-18)

The number of electrons, protons and neutrons of four atoms are given as follows:

Atoms	P	Q	R	S
No. of electrons	9	16	19	13
No. of protons	9	16	19	13
No. of neutrons	10	16	20	14

Answer the following questions on the basis of above information.

17. Which forms cation(+ve ion) with supply of the lowest amount of energy?
 (A) P (B) Q
 (C) R (D) S
18. What is the angular momentum (mvr) of the third orbit of S²⁻ ion?
 (A) $\frac{h}{\pi}$ (B) $\frac{3h}{2\pi}$
 (C) $\frac{h}{2\pi}$ (D) $\frac{2h}{\pi}$

Space For Rough Work

Match Type

This section contains Two (02) List-Match Sets, each List-Match set has One (01) Multiple Choice Questions. Each List-Match set has two lists: List-I and List-II. FOUR options are given in each Multiple Choice Question based On List-I and List-II and ONLY ONE of these four options satisfies the condition asked in the Multiple Choice Question.

19. Arrange the atoms mentioned in Column-I with their characteristics mentioned in Column-II.

Column – I		Column – II	
(A)	Mg	(P)	Contains one valence electron
(B)	Ca	(Q)	Contains more than one valence electrons
(C)	K	(R)	The highest energetic occupied orbit is the fourth orbit
(D)	Na	(S)	Contains exactly three occupied orbits

- (A) A → QS, B → QR, C → PR, D → PS (B) A → QR, B → QS, C → PR, D → PS
 (C) A → QS, B → PR, C → QR, D → PS (D) A → QS, B → QR, C → PS, D → PR

20. Match the following.

Column – I		Column – II	
(A)	4 g NaOH dissolved in 100 mL solution	(P)	0.05 M
(B)	4.9 g of H ₂ SO ₄ dissolved in 1000 mL solution	(Q)	0.25 M
(C)	5.3 g of Na ₂ CO ₃ dissolved in 500 mL solution	(R)	1.00 M
(D)	1.5 g of CH ₃ COOH dissolved in 100 mL solution	(S)	0.1 M

- (A) A-P, B-R, C-S, D-Q (B) A-R, B-P, C-S, D-Q
 (C) A-R, B-S, C-P, D-Q (D) A-R, B-P, C-Q, D-S

Space For Rough Work

PART – B
Numerical Based

This section contains 6 questions. The answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries +3 marks for correct answer.

1. How many electrons are present in the second orbit of Mg^{2+} ion?
 2. To prepare 100 g of 92% by weight solution of NaOH, how many gram of H_2O is needed?
 3. Maximum number of electrons in an atom which can have $n = 2$ is
 4. Calculate the number of moles of carbon atom present in three moles of ethane (C_2H_6).
 5. Given charge of electron is $-1.6 \times 10^{-19}\text{C}$ and mass of electron is $9.1 \times 10^{-31}\text{ kg}$. Then the charge to mass ratio of cathode rays is $x \times 10^{11}\text{ C kg}^{-1}$. Find x
 6. The density of a solution prepared by dissolving 300 g of urea in 1000 g of water is 1.15 g/ml. Calculate molarity of solution. [Urea = NH_2CONH_2]
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SECTION – III (MATHEMATICS)

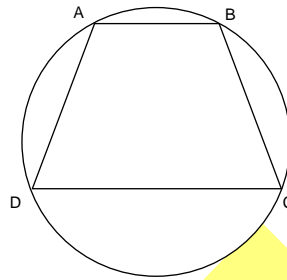
PART – A

Multiple Correct Choice Type

This section contains 7 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE THAN ONE are correct.

1. In the given figure, $AB \parallel CD$ then

- (A) $\angle A = \angle C$
- (B) $AC = BD$
- (C) $\angle D = \angle C$
- (D) BD is diameter



2. Which of the following is/are factor of the polynomial $f(x) = 2x^3 - 3x^2 - 17x + 30$?

- (A) $(x + 3)$
- (B) $(x - 3)$
- (C) $(x - 2)$
- (D) $(x + 2)$

3. If two dice are thrown simultaneously then which of the following is/are correct?

- (A) the probability of not getting doublet is $\frac{5}{6}$
- (B) the probability of getting a total of at least 10 is $\frac{1}{6}$
- (C) the probability of not getting a total as a perfect square is $\frac{29}{36}$
- (D) None of these

4. Which of the following is/are correct ?

- (A) If two sides of a triangle are unequal, the larger side has the greater angle opposite to it.
- (B) The sum of any two sides of a triangles is greater than or equal to its third side.
- (C) If all the line segments that can be drawn to a given line from an external point, the perpendicular line segment is the shortest.
- (D) If all the three sides of a triangles are equal, it is called a scalene triangle

5. Which of the following are measures of central tendency?

- (A) mean
- (B) median
- (C) mode
- (D) variance

Space For Rough Work

6. $\frac{1}{(\sqrt{3} - \sqrt{2})}$ is equal to

(A) $\sqrt{3} + \sqrt{2}$

(B) $\frac{\sqrt{2}}{(\sqrt{6} - 2)}$

(C) $\frac{(\sqrt{3} - \sqrt{2})}{(5 - 2\sqrt{6})}$

(D) $\frac{\sqrt{3}}{(9 - \sqrt{6})}$

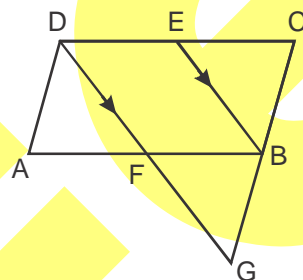
7. In the adjoining figure, ABCD is a parallelogram. E is the midpoint of DC and through D, a line segment is drawn parallel to EB to meet CB produced at G and it cuts AB at F. Then:

(A) $AD = \frac{1}{2} GC$

(B) $DG = 2 \cdot EB$

(C) $EB = DG$

(D) $BG = BC$



Single Correct Choice Type

This section contains 7 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE option is correct.

8. If the mean of set of observations x_1, x_2, \dots, x_{10} is 20 then mean of

$x_1 + 4, x_2 + 8, x_3 + 12, \dots, x_{10} + 40$ is

(A) 34

(B) 42

(C) 28

(D) 40

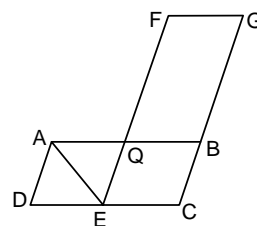
9. In figure ABCD and FECG are parallelograms equal in area. If $ar(\Delta AQE) = 12 \text{ cm}^2$, then $ar(\text{||}^{\text{gm}} \text{FGBQ})$ is equal to

(A) 12 cm^2

(B) 20 cm^2

(C) 24 cm^2

(D) 36 cm^2



10. In ΔABC , AD is the median and P is the mid point of AD. If area $(\Delta BPC) = 16 \text{ cm}^2$, then find

$\frac{3}{4}$ area (ΔAPC) .

(A) 4 cm^2

(B) 8 cm^2

(C) 6 cm^2

(D) 32 cm^2

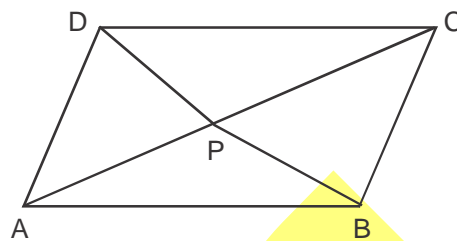
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11. In the given figure, P is point in the interior of parallelogram ABCD. If the area of parallelogram ABCD is 60cm^2 ,

$$\frac{1}{10} \times (\text{area of } \triangle ADP + \text{area of } \triangle BPC) =$$

(A) 5
(C) 3

(B) 6
(D) 2



12. A letter of English alphabet is chosen at random. Determine the probability that the chosen letter is a consonant.

(A) $\frac{21}{26}$

(B) 1

(C) $\frac{5}{26}$

(D) None of these

13. A cylindrical tank of diameter 40 cm is full of water. If 22000 cm^3 of water is drawn off, the water level in the tank will drop by:

(A) 10.5 cm

(B) 12 cm

(C) 14 cm

(D) 17.5 cm

14. A coin and a dice is thrown once simultaneously. What is the probability of getting Head on die and even number on coin?

(A) $\frac{1}{2}$

(B) $\frac{2}{3}$

(C) $\frac{1}{3}$

(D) $\frac{1}{4}$

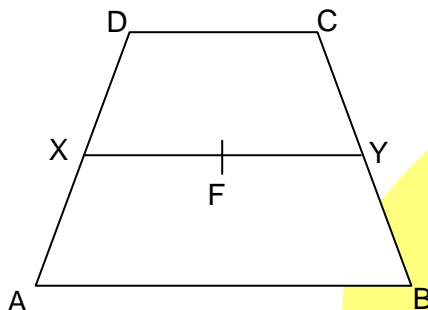
Space For Rough Work

Comprehension Type

This section contains 2 Paragraphs which has two multiple choice questions each. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE option is correct.

Paragraph - I (15-16)

ABCD is a trapezium in which $AB \parallel DC$ and $DC = 40$ cm and $AB = 60$ cm. If X and Y are respectively, the midpoints of AD and BC, then



15. $XY =$
 (A) 40 cm
 (B) 50 cm
 (C) 60 cm
 (D) 30 cm
16. DCYX is a
 (A) Trapezium
 (B) Parallelogram
 (C) Rectangle
 (D) Square

Paragraph –II (17-18)

Rohan has five coins, which he tossed simultaneously 250 times and record the outcomes as given in the table below.

Outcomes	5 tails	4 tails	3 tails	2 tails	1 tail	0 tail
Frequency	45	25	50	35	65	30

If he wants to toss these 5 coins again, then find

17. Probability of getting 3 tails is
 (A) $\frac{1}{2}$ (B) $\frac{1}{5}$ (C) $\frac{1}{3}$ (D) $\frac{2}{3}$
18. Probability of getting atleast 4 tails is
 (A) $\frac{7}{25}$ (B) $\frac{3}{25}$ (C) $\frac{3}{50}$ (D) $\frac{7}{50}$

Space For Rough Work

Match Type

This section contains Two (02) List-Match Sets, each List-Match set has One (01) Multiple Choice Questions. Each List-Match set has two lists: List-I and List-II. FOUR options are given in each Multiple Choice Question based On List-I and List-II and ONLY ONE of these four options satisfies the condition asked in the Multiple Choice Question.

19. Match the column I & column II.

Column I		Column II	
(A)	The probability of getting an even number, when a die is thrown once, is	(P)	$\frac{1}{6}$
(B)	A pair of dice is thrown once. Find the probability of getting the same number on each dice.	(Q)	$\frac{3}{7}$
(C)	Out of 200 bulbs in a box, 12 bulbs are defective. One bulb is taken out at random from the box. What is the probability that the drawn bulb is not defective?	(R)	$\frac{1}{2}$
(D)	If a number x is chosen at random from the numbers $-3, -2, -1, 0, 1, 2, 3$, then find the probability of $x^2 < 4$.	(S)	$\frac{47}{50}$

- (A) A – R; B – P; C – Q; D – S
 (B) A – R; B – P; C – R; D – Q
 (C) A – R; B – P; C – S; D – Q
 (D) A – Q; B – S; C – R; D – P

20. Match the following

Column-I		Column-II	
(A)	Mean of first n odd natural numbers	(P)	$\frac{n(n+1)^2}{4}$
(B)	Mean of first n even natural numbers	(Q)	$\frac{n+1}{2}$
(C)	Mean of first n natural numbers	(R)	$n+1$
(D)	Mean of cubes of first n natural numbers	(S)	n

- (A) A – R; B – P; C – Q; D – S
 (B) A – S; B – R; C – P; D – Q
 (C) A – R; B – S; C – Q; D – P
 (D) A – S; B – R; C – Q; D – P

Space For Rough Work

PART – B
Numerical Based

This section contains 6 questions. The answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries +3 marks for correct answer.

1. A sphere of diameter 6 cm is dropped in a right circular cylindrical vessel partly filled with water. The diameter of the cylindrical vessel is 12 cm. If the sphere is completely submerged in water, by how much cm will the level of water rise in the cylindrical vessel?
2. A bag contains total 20 balls of color: Red, Green and White. If probability of drawing a green or white ball is 0.6 then what is the number of Red balls in the bag?
3. The surface area of a solid metallic sphere is 616 cm^2 . It is melted and moulded into a cone of height 28 cm. Find the radius (in cm) of the base of cone so formed.
4. A number is chosen randomly from all two digit natural numbers. If $\frac{a}{b}$ is the probability that chosen number is divisible by 5 then $a + b = ?$
5. Find the mode when median is 12 and mean is 16 of a data.
6. A frequency distribution

Daily Wages (in Rs.)	5	6	7	10	12	15
No. of workers	10	f	8	8	5	4

has arithmetic mean 8.4, then $f =$

Space For Rough Work

TEST CODE: 100859

ANSWER KEYS

Physics

Part – A

- | | | | | | | | |
|-----|-----|-----|-----|-----|----|-----|-----|
| 1. | ACD | 2. | AB | 3. | CD | 4. | ACD |
| 5. | AB | 6. | ABC | 7. | BC | 8. | A |
| 9. | C | 10. | B | 11. | A | 12. | C |
| 13. | D | 14. | A | 15. | D | 16. | A |
| 17. | D | 18. | D | 19. | D | 20. | C |

Part – B

- | | | | | | |
|----|-----------------------------------|----|---|----|------|
| 1. | 16.97 (range from 16.95 to 17.00) | 2. | 6 | 3. | 3.33 |
| 4. | 10.5 | 5. | 5 | 6. | 3 |

Chemistry

Part – A

- | | | | | | | | |
|-----|------|-----|----|-----|-----|-----|-----|
| 1. | ABCD | 2. | AB | 3. | ACD | 4. | ABC |
| 5. | ABC | 6. | AB | 7. | BC | 8. | D |
| 9. | D | 10. | A | 11. | C | 12. | A |
| 13. | B | 14. | A | 15. | B | 16. | C |
| 17. | C | 18. | B | 19. | A | 20. | B |

Part – B

- | | | | | | | | |
|----|------|----|------|----|---|----|---|
| 1. | 8 | 2. | 8 | 3. | 8 | 4. | 6 |
| 5. | 1.75 | 6. | 4.42 | | | | |

Mathematics

Part – A

- | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|----|
| 1. | BC | 2. | AC | 3. | ABC | 4. | AC |
| 5. | ABC | 6. | ABC | 7. | ABD | 8. | B |
| 9. | C | 10. | C | 11. | C | 12. | A |
| 13. | D | 14. | D | 15. | B | 16. | A |
| 17. | B | 18. | A | 19. | C | 20. | D |

Part – B

- | | | | | | | | |
|----|---|----|---|----|---|----|---|
| 1. | 1 | 2. | 8 | 3. | 7 | 4. | 6 |
| 5. | 4 | 6. | 5 | | | | |

Answers & Solutions

SECTION – I (PHYSICS)

PART – A

1. ACD

Sol. Initial P.E. = $mgh = 4\text{ J}$

Final P.E. after rebounds = $mgh = 2.8\text{ J}$

$$\% \text{ loss in energy} = \left(\frac{4 - 2.8}{4} \right) \times 100 = 30\%$$

Change in mechanical energy = $4 - 2.8 = 1.2\text{ J}$

Momentum (p) = $m.v.$

At topmost point velocity is 0

So $p = 0$

2. AB

Sol. Upthrust (F_B) = $\rho g v$

3. CD

$$\text{Sol. } F = m \left(\frac{v - u}{t} \right) = \frac{10}{1000} \times \left(\frac{150}{0.03} \right) = \frac{10}{1000} \times \frac{150}{3} \times 100 = 50\text{ N}$$

$$S = \frac{v^2 - u^2}{2a} = \frac{(150)^2}{2 \times 5000}$$

$$= 2.25\text{ m}$$

4. ACD

Sol. Upthrust = $\rho g v = \text{loss in weight}$

5. AB

Sol. High power and good directionality are the properties of ultrasonic waves.

6. ABC

Sol. When a force retards the motion of a body its kinetic energy always decreases, the work done by the force is negative as the force acts opposite to the displacement.

7. BC

Sol. When wave travels from one medium to another, wavelength and velocity are quantities that change.

8. A

$$\text{Sol. } t_1 = \frac{2u \sin \theta}{g} \text{ and}$$

$$t_2 = \frac{2u \sin(90 - \theta)}{g} = \frac{2u \cos \theta}{g}$$

$$\therefore t_1 t_2 = \frac{4u^2 \cos \theta \sin \theta}{g^2} = \frac{2}{g} \left[\frac{u^2 \sin \theta}{g} \right] = \frac{2}{g} R$$

where R is the range.

Hence $t_1 t_2 \propto R$

9. C

Sol. Acceleration = $\frac{\text{Net force in the direction of motion}}{\text{Total mass of system}}$

$$= \frac{m_1 g - \mu(m_2 + m_3)g}{m_1 + m_2 + m_3} = \frac{g}{3}(1 - 2\mu)$$

10. B

Sol. P.E. in case of spring = $\frac{1}{2}kx^2$

Increase in potential energy

$$\frac{1}{2}k(k_1 + x_2)^2 - \frac{1}{2}kx_1^2 = \frac{1}{2}k(2x_1x_2 + x_2^2) = \frac{1}{2}kx_2(x_2 + 2x_1)$$

11. A

Sol. $\frac{1}{2}mv^2 = \frac{1}{2}kx^2 \Rightarrow mv^2 = kx^2$ or $m \times (1.5)^2 = 50 \times (0.15)^2$

$$\therefore m = 0.5 \text{ kg}$$

12. C

Sol. Power = $\frac{\text{work done}}{\text{time}}$ Therefore power A, $P_A = \frac{mgh}{t_A}$ and power of B, $P_B = \frac{mgh}{t_B}$

$$\therefore \frac{P_A}{P_B} = \frac{t_B}{t_A} = \frac{4}{2} = 2 : 1$$

13. D

Sol. Weight of submerged part of the block

$$W = \frac{1}{3}v(\text{Density of water})g \quad \dots(i)$$

Excess weight, = weight of water having $\frac{2}{3}$ volume of the block

$$W' = \frac{2}{3}v(\text{Density of water})g \quad \dots(ii)$$

Dividing (ii) by (i),

$$\frac{W'}{W} = \frac{2/3}{1/3} \quad \therefore W' = 2W \Rightarrow W' = 2 \times 6 = 12 \text{ kg}$$

14. A

Sol. Because they are absorbed by the atmosphere

15. D

Sol. Let T be the tension at the midpoint C of wire B, Then

$$T - \left(m_2 + \frac{m_3}{2}\right)g = \left(m_2 + \frac{m_3}{2}\right)a$$

$$\Rightarrow T = \left(m_2 + \frac{m_3}{2}\right)(g + a)$$

$$= \left(2m + \frac{m}{2}\right)(g + a)$$

$$= \frac{5}{2}m(g + a),$$

16. A

Sol. Let T_1 be the tension in wire A. Since this wire has negligible mass, the tension is the same ($= T_1$) at every point on this wire. Let T_2 be the tension at point O of wire B. Then, we have for wire A.

$$T_1 - T_2 = m_1 g = m_1 a$$

where T_2 is given by

$$T_2 - (m_2 + m_3)g = (m_2 + m_3)a$$

$$T_2 = (m_2 + m_3)(g + a)$$

$$= (2m + m)(g + a) = 3m(g + a)$$

17. D

Sol. Frequency (f) = number of waves per second.

18. D

Sol. $v = f\lambda$

19. D

Sol. Using gravitational force and escape velocity.

20. C

Sol. (A) \rightarrow (4); (B) \rightarrow (1); (C) \rightarrow (2); (D) \rightarrow (3)

PART - B

1. 16.97

(Range from 16.95 to 17.00)

Sol. Force on the bob in the direction of motion of the train = $T \sin \theta$. Hence the equation for horizontal direction is

$$T \sin \theta = ma \quad \dots(i)$$

For equilibrium along the vertical direction

$$T \cos \theta = mg \quad \dots(ii)$$

Dividing (i) and (ii), we get

$$a = g \tan \theta = 9.8 \times 1.732 = 16.97 \text{ m/s}^2$$

2. 6

Sol. $T - mg = ma$

$$\Rightarrow T = m(a + g)$$

$$= 2 \times (2.2 + 9.8)$$

$$= 24 \text{ N}$$

$$\text{Work done by tension is } (W) = TS \cos 0 = 24 \times 4 \times 1 = 96 \text{ J}$$

3. 3.33

Sol. Volume of tank = 2000 liter = 2 m^3 (1 liter = 10^{-3} m^3)

$$\text{Mass of water } (m) = \rho V = 2 \times 10^3 \text{ kg}$$

$$\text{Work done to lift this mass } (W) = mgh = 8 \times 10^5 \text{ J}$$

$$\text{Power needed} = \frac{W}{t} = \frac{8 \times 10^5}{10 \times 60} = \frac{4}{3} \times 10^3 \text{ W}$$

If P is the total power consumed, the useful power available = 40% if $P = 0.4 P$. Hence

$$0.4P = \frac{4}{3} \times 10^3 \Rightarrow P = 3.33 \text{ kW}$$

4. 10.5

Sol. Density of iron = $7.2 \times 10^3 \text{ kg m}^{-3}$

$$V = \frac{\text{mass}}{\text{density}} = \frac{7.2}{7.2 \times 10^3} = 10^{-3} \text{ m}^3$$

$$\text{Volume of iron immersed in water} = \frac{V}{2}$$

$$\therefore \text{Weight of water displaced} = \frac{V}{2} \times 1000 \times g$$

$$= \frac{10^{-3}}{2} \times 1000 \times g = 0.5 \text{ g}$$

= weight of 0.5 kg

This is the buoyant force on the iron piece. Hence, according to Newton's third law, the iron piece will exert an equal force on water in the downward direction. Hence the balance will now read = 10 kg + 0.5 kg = 10.5 kg

5. 5

Sol. $v = f\lambda$

6. 3

Sol. $v = f\lambda$

SECTION – II (CHEMISTRY)**PART – A**

1. ABCD

Sol. All of the given statements have same amount of oxygen i.e. 16 g.

2. AB

Sol. Heat responsible for the interconversion of physical state of matter and not raise the temperature are Latent heat of fusion and latent heat of vapourisation.

3. ACD

Sol. Atoms of same element are identical in size, shape, mass and properties as per Dalton's atomic theory.

4. ABC

Sol. Charge on one mole of electrons = $1.6 \times 10^{-19} \times 6.022 \times 10^{23}$
= 96500 Coulomb
= 1 Faraday

5. ABC

Sol. Argon has 18 electrons. So as in Cl^- , Ca^{2+} & S^{2-} .

6. AB

Sol. Be and B metals were used for the discover of neutrons.

7. BC

Sol. Bohr's theory does not apply to Be and He as it is only explained for hydrogen and hydrogen like species.

8. D

Sol. Let number of protons be x
 \therefore Number of electrons = $x - 3$
Mass number = Number of protons + Number of neutrons
 $x + x + 4 = 52$; $2x + 4 = 52$
 $2x = 52 - 4$; $x = \frac{48}{2} = 24$

9. D

Sol. Number of moles = $\frac{12.044 \times 10^{23}}{6.022 \times 10^{23}} = 2$
 \therefore Mass of 1 mole of O_2 molecule is 32 g.
 \therefore Mass of 2 moles of O_2 molecules = $2 \times 32 = 64$ g

10. A

Sol. 1 g of H-atom = 6×10^{23} atoms
4 g of He atom = 6×10^{23} atoms
1 g of He atom = $\frac{1}{4} \times 6 \times 10^{23}$

11. C

Sol. Number of moles = $\frac{67.2}{22.4} = 3$ moles

12. A

Sol. 3.2 of $\text{O}_2 = \frac{3.2}{32} = 0.1$ mol
= $0.1 \times 6.022 \times 10^{23}$ molecules

Four Yr CRP428 (R & W)_PT-3+4_IITJEE_24
 $= 0.1 \times 6.022 \times 10^{23} \times 16$ electrons
 $= 9.635 \times 10^{23}$ electrons

13. B

Sol. $n = \frac{222}{111} = 2$ moles

Number of molecules in $\text{CaCl}_2 = 2 N_A$

Number of chloride ions $= 2 N_A \times 2$

$= 24.08 \times 10^{23}$ ions

14. A

Sol. Number of Na-atoms $= n \times N_A = 1 \times 6.022 \times 10^{23}$ atoms

Number of neutrons in 23 g of sodium

Metal $= 12 \times 6.022 \times 10^{23} = 72.264 \times 10^{23}$ neutrons

15. B

Sol. Gram atomic mass of an atom and gram molecular mass of a molecule will be equal to weight of 1 mole of atom and molecule respectively.

16. C

Sol. 12 grams of carbon will be there in container.

17. C

Sol. R with configuration 2, 8, 9 can lose 1 electron easily to achieve complete octet.

18. B

Sol. Angular momentum of n-orbit is $= \frac{nh}{2\pi}$

19. A

Sol. Mg – 2, 8, 2

Ca – 2, 8, 8, 2

K – 2, 8, 8, 1

Na – 2, 8, 1

Valence orbit is the highest energetic orbit.

20. B

Sol. 4 g of NaOH in 100 ml solution $= \frac{4 \times 1000}{40 \times 100} = 1$ M

4.9 g of H_2SO_4 in 1000 ml solution $= \frac{4.9 \times 1000}{98 \times 1000} = 0.05$ M

5.3 g of Na_2CO_3 in 500 ml solution $= \frac{5.3 \times 1000}{106 \times 500} = 0.1$ M

1.5 g of CH_3COOH in 100 ml solution $= \frac{1.5 \times 1000}{60 \times 100} = 0.25$

PART – B

1. 8

Sol. Electronic configuration of Mg^{2+} is 2, 8.

2. 8

Sol. 92 g of NaOH and 8 g of water is needed

3. 8

Sol. Maximum number of electrons in an atom which can have $n = 2$ is 8

4. 6

Sol. Number of moles of carbon atom present in 3 moles of ethane = $3 \times 2 = 6$ moles

5. 1.75

Sol. Cathode ray is electron

$$\Rightarrow \frac{e}{m} = \frac{1.6 \times 10^{-19} \text{ C}}{9.1 \times 10^{-31} \text{ Kg}} = \frac{16}{91} \times 10^{12} = 1.75 \times 10^{11} \text{ C kg}^{-1}$$

6. 4.42

Sol. Number of moles solute = $\frac{300}{60} = 5$ moles

$$\text{Volume of solution} = \frac{\text{Mass of solution}}{\text{Density of solution}} = \frac{300 + 1000}{1.15} = 1.13 \text{ L}$$

$$\text{Molarity} = \frac{5}{1.13} = 4.42 \text{ M}$$

Space For Rough Work

SECTION – III (MATHEMATICS)**PART – A**

1. BC

Sol. In a cyclic trapezium diagonals are equal $\Rightarrow AC = BD$
 and $\angle A + \angle D = 180^\circ \Rightarrow \angle D = 180 - \angle A$
 also $\angle A + \angle C = 180^\circ \Rightarrow \angle C = 180 - \angle A$

2. AC

Sol. By factor theorem, $(x + 3)$ will be a factor of $f(x)$, if $f(-3) = 0$.

$$\begin{aligned} \text{We have, } f(-3) &= 2 \times (-3)^3 - 3(-3)^2 - 17 \times (-3) + 30 \\ &= -54 - 27 + 51 + 30 = 0 \end{aligned}$$

Hence, $(x + 3)$ is a factor of $f(x)$.

$$\begin{aligned} \text{Now, let } f(2) &= 2(2)^3 - 3(2)^2 - 17(2) + 30 \\ &= 16 - 12 - 34 + 30 = 0 \end{aligned}$$

Therefore, 2 is the zero of $f(x)$ i.e., $(x - 2)$ is a factor of $f(x)$.

$$\begin{aligned} \text{Again } f\left(\frac{5}{2}\right) &= 2\left(\frac{5}{2}\right)^3 - 3\left(\frac{5}{2}\right)^2 - 17\left(\frac{5}{2}\right) + 30 \\ &= \frac{125}{4} - \frac{75}{4} - \frac{85}{2} + 30 = 0 \end{aligned}$$

Therefore, $\frac{5}{2}$ is also a zero of $f(x)$ i.e. $(2x - 5)$ is factor of $f(x)$.

$$\text{Hence, } 2x^3 - 3x^2 - 17x + 30 = (x + 3)(x - 2)(2x - 5)$$

3. ABC

Sol. Two dice are thrown simultaneously

Total number of outcomes = 36

$$\text{Doublet} = \{(1,1), (2,2), (3,3), (4,4), (5,5), (6,6)\}$$

$$\text{Total of at least 10} = \{(4,6), (5,5), (6,4), (5,6), (6,5), (6,6)\}$$

$$\text{Total is perfect square} = \{(1,3), (2,2), (3,1), (3,6), (4,5), (5,4), (6,3)\}$$

$$\text{(a) } P(\text{doublet}) = \frac{6}{36} = \frac{1}{6}$$

$$P(\text{not doublet}) = 1 - \frac{1}{6} = \frac{5}{6}$$

$$\text{(b) } P(\text{getting total of at least 10}) = \frac{6}{36} = \frac{1}{6}$$

$$\text{(c) } P(\text{perfect square}) = \frac{7}{36}$$

$$P(\text{not a perfect square}) = 1 - \frac{7}{36} = \frac{29}{36}$$

4. AC

Sol. If two sides of a triangle are unequal, the larger side has the greater angle opposite to it
 If all the line segments that can be drawn to a given line from an external point, the perpendicular line segment is the shortest.

5. ABC

Sol. Mean, mode and median are measure of central tendency.

6. ABC

Sol.

$$(A) \quad \sqrt{3} + \sqrt{2} = \sqrt{3} + \sqrt{2} \times \frac{\sqrt{3} - \sqrt{2}}{\sqrt{3} - \sqrt{2}} = \frac{1}{\sqrt{3} - \sqrt{2}}$$

$$(B) \quad \frac{\sqrt{2}}{\sqrt{6} - 2} = \frac{\sqrt{2}}{\sqrt{2}(\sqrt{3} - \sqrt{2})} = \frac{1}{\sqrt{3} - \sqrt{2}}$$

$$(C) \quad \frac{\sqrt{3} - \sqrt{2}}{5 - 2\sqrt{6}} \times \frac{5 + 2\sqrt{6}}{5 + 2\sqrt{6}}$$

$$= 5\sqrt{3} + 6\sqrt{2} - 5\sqrt{2} - 4\sqrt{3} = \sqrt{3} + \sqrt{2}$$

$$(D) \quad \frac{\sqrt{3}}{9 - \sqrt{6}} = \frac{\sqrt{3}}{\sqrt{3}(3\sqrt{3} - \sqrt{2})} = \frac{1}{3\sqrt{3} - \sqrt{2}}$$

7. ABD

Sol. DG = 2 EB (by converse of mid point theorem)

Also B is the mid point of GC

BG = BC

$$\Rightarrow BC = \frac{1}{2}GC = AD$$

8. B

Sol.

Mean = 20

Number of observations = 10

$$\text{Now, new mean} = \frac{(x_1 + 4) + (x_2 + 8) + \dots + (x_{10} + 40)}{10}$$

$$= \frac{(x_1 + x_2 + \dots + x_{10}) + (4 + 8 + 12 + \dots + 40)}{10}$$

$$= \frac{x_1 + x_2 + \dots + x_{10}}{10} + \frac{4(1 + 2 + 3 + \dots + 10)}{10}$$

$$= 20 + \frac{4(10)(11)}{10 \times 2}$$

$$= 20 + 22 = 42$$

9. C

Sol.

$$\text{ar}(\parallel^{\text{gm}} ABCD) = \text{ar}(\parallel^{\text{gm}} FECD)$$

$$\Rightarrow \text{ar}(\parallel^{\text{gm}} ABCD) - \text{ar}(\parallel^{\text{gm}} BQEC)$$

$$= \text{ar}(\parallel^{\text{gm}} FECD) - \text{ar}(\parallel^{\text{gm}} BQEC)$$

$$\Rightarrow \text{ar}(\parallel^{\text{gm}} ADEQ) = \text{ar}(\parallel^{\text{gm}} FGBQ)$$

$$\text{Now, ar}(\parallel^{\text{gm}} AQED) = \text{ar}(\triangle ADE) + \text{ar}(\triangle AQE) = 12 + 12 = 24 \text{ cm}^2$$

$$\text{So, ar}(\parallel^{\text{gm}} FGBQ) = 24 \text{ cm}^2$$

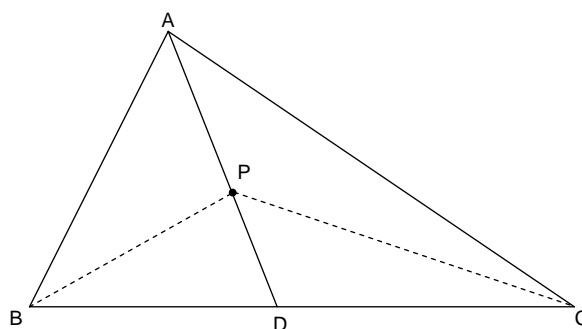
10. C

Sol.

$$\text{ar}(\triangle DPC) = \frac{1}{2} \text{ar}(\triangle BPC) = 8 \text{ cm}^2$$

$$\text{But ar}(\triangle DPC) = \text{ar}(\triangle APC) = 8 \text{ cm}^2$$

$$\frac{3}{4} \text{ar}(\triangle APC) = \frac{3}{4} \times 8 = 6 \text{ cm}^2$$



11. C

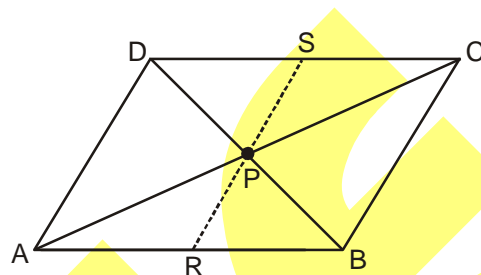
Sol. $\text{ar ADP} = \frac{1}{2} \text{ar ARSD} \quad \dots \text{(i)}$

$\text{ar BPC} = \frac{1}{2} \text{ar BRSC} \quad \dots \text{(ii)}$

add (i) + (ii)

$$\begin{aligned} \text{ar ADP} + \text{ar BPC} &= \frac{1}{2} [\text{ar ARSD} + \text{ar BRSC}] \\ &= \frac{1}{2} [\text{ar (ABCD)}] \\ &= \frac{1}{2} [\text{ar (ABCD)}] \\ &= \frac{1}{2} \times 60 = 30 \text{ cm}^2 \end{aligned}$$

$$\frac{1}{10} \times (\text{area of } \triangle \text{ADP} + \text{area of } \triangle \text{BPC}) = \frac{30}{10} = 3 \text{ cm}^2$$



12. A

Sol. There are 21 consonants in English alphabets.

$$\therefore \text{Required probability} = \frac{21}{26}$$

13. D

Sol. Volume of water drawn off = 22000 cm³

$$\Rightarrow \frac{22}{7} \times 20 \times 20 \times h = 22000$$

$$\Rightarrow h = 17.5 \text{ cm}$$

14. D

Sol. Total possible outcomes = (H, 1), (H, 2), (H, 3), (H, 4), (H, 5), (H, 6)
(T, 1), (T, 2), (T, 3), (T, 4), (T, 5), (T, 6)
= 12

Favourable outcomes = {(H, 2), (H, 4), (H, 6)} = 3

$$\text{Probability} = \frac{3}{12} = \frac{1}{4}$$

15. B

Sol. X, Y are mid points of AD, BC respectively.

So, $XY \parallel AB \parallel DC$

$$XY = \frac{1}{2} (AB + DC) = \frac{1}{2} (60 + 40) = 50 \text{ cm.}$$

16. A

Sol. $AB \parallel DC$

$XY \parallel AB \parallel DC$

Hence, DCYX is a trapezium.

17. B

Sol. Required probability = $\frac{50}{250} = \frac{1}{5}$

18. A

Sol. Required probability = $\frac{(25 + 45)}{250} = \frac{7}{25}$

19. C

Sol. (A) Favourable cases = $\{2, 4, 6\}$

$$\therefore \text{Required probability} = \frac{3}{6} = \frac{1}{2}$$

(B) Favourable cases = $\{(1,1), (2,2), (3,3), (4,4), (5,5), (6,6)\}$

$$\therefore \text{Required probability} = \frac{6}{36} = \frac{1}{6}$$

(C) Total number of bulbs = 200
Number of defective bulbs = 12
 \therefore Number of bulbs which are not defective
= $200 - 12 = 188$

$$\therefore \text{Required probability} = \frac{188}{200} = \frac{47}{50}$$

(D) Number of favourable outcomes = 3 i.e. $\{-1, 0, 1\}$

$$\therefore P(x^2 < 4) = \frac{3}{7}$$

20. D

Sol.

(A) Mean of first n odd natural number = $\frac{n^2}{n} = n$

(B) Mean of first n even natural numbers = $2 \left[\frac{n(n+1)}{2n} \right]$
= $n+1$

(C) Mean of first n natural numbers = $\frac{n(n+1)}{2n} = \frac{n+1}{2}$

(D) Mean of cubes of first n natural numbers = $\frac{n^2(n+1)^2}{4n}$
= $\frac{n(n+1)^2}{4}$

PART - B

1. 1

Sol. Let the height of water level raised in cylindrical vessel be h cm.

Radius of sphere, $r = \frac{6}{2} = 3$ cm

Radius of cylinder, $R = \frac{12}{2} = 6$ cm

Volume of sphere = Volume of water displaced in cylinder

$$\Rightarrow \frac{4}{3}\pi r^3 = \pi R^2 h \Rightarrow \frac{4}{3}\pi(3)^3 = \pi(6)^2 h$$

$$\Rightarrow \frac{4}{3} \times 27 = 36h \Rightarrow 36 = 36h \Rightarrow h = 1$$

2. 8

Sol. Probability of Red ball = $1 - \frac{3}{5} = \frac{2}{5} = \frac{8}{20}$

So Red balls = 8

3. 7

Sol. Given : Surface area of sphere = 616 cm²

$$\Rightarrow 4 \times \frac{22}{7} \times r^2 = 616 \Rightarrow r = 7 \text{ cm}$$

Let radius of cone = R cm

$$\Rightarrow \frac{4}{3} \pi \times 7 \times 7 \times 7 = \frac{1}{3} \pi R^2 \times 28$$

$$\Rightarrow R = 7 \text{ cm}$$

4. 6

Sol. Total numbers = {10, 11, 12, 13,99} = 90

Numbers divisible by 5 = {10, 15,95} = 18

$$\text{Probability} = \frac{18}{90} = \frac{1}{5} = \frac{a}{b}$$

$$\Rightarrow a + b = 5 + 1 = 6$$

5. 4

Sol. Mode = 3 Median – 2 Mean

$$= (3 \times 12) - (2 \times 16) = 36 - 32 = 4$$

6. 5

Sol. $\frac{\sum fix_i}{\sum fi} = 8.4$

$$\Rightarrow \frac{(10 \times 5) + (6 \times f) + (7 \times 8) + (10 \times 8) + (12 \times 5) + (15 \times 4)}{35 + f} = 8.4$$

$$\Rightarrow \frac{306 + f}{35 + f} = 8.4$$

$$\Rightarrow 306 + 6f = 294 + 8.4f$$

$$\Rightarrow 12 = 2.4f$$

$$f = 5$$