

VIDYA DRISHTI
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IIT-JEE 2010 Test Series 2
Paper II

Physics Part-II

SECTION I

STRAIGHT OBJECTIVE TYPE

This section contains 9 multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer.

1. A source of sound of frequency 50 Hz is moving towards a wall with a velocity of $V_s = 5$ m/s. Speed of sound in air is 330 m/s. The number of beats per second heard by an observer O, standing in such a position that the source S is between observer and the wall, is
- a) 7.7 Hz
b) 2.5 Hz
c) 8.8 Hz
d) 4 Hz



2. The equation of a stationary wave is $y = \sin \frac{\pi x}{3} \cos 10\pi t$ where x and y are in cm and t in seconds. The separation between two consecutive nodes is
- a) 1.5 cm b) 6.0 cm c) 3.0 cm d) 18 cm

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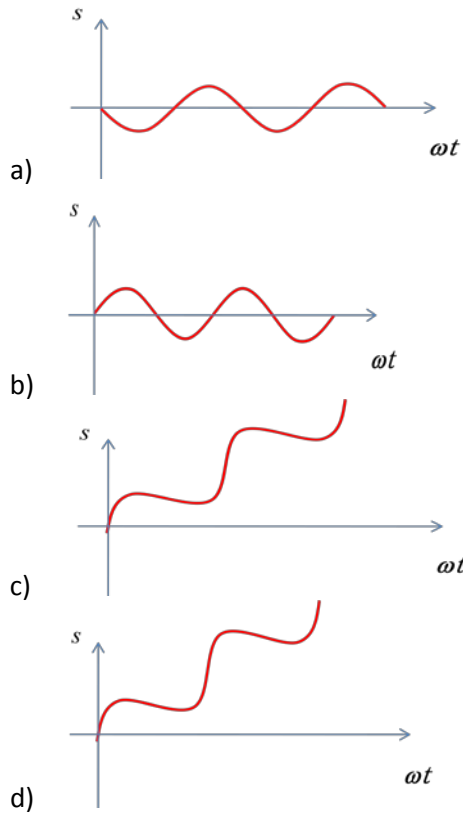
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3. A plane progressive wave is travelling with wave vector \vec{k} ; \hat{n} is the unit vector in the direction of propagation. If the wave is longitudinal, then which one of the following is correct?
- a) $\hat{n} \times \vec{k} \neq \vec{0}$, $\hat{n} \cdot \vec{k} = 0$
b) $\hat{n} \times \vec{k} = \vec{0}$, $\hat{n} \cdot \vec{k} \neq 0$
c) $\hat{n} \times \vec{k} = \vec{0}$, $\hat{n} \cdot \vec{k} = 0$
d) $\hat{n} \times \vec{k} \neq \vec{0}$, $\hat{n} \cdot \vec{k} \neq 0$
4. If three segments of a wire having fundamental frequency of vibrations ν_1 , ν_2 and ν_3 respectively are joined together in series under the same tension, the fundamental frequency of the whole wire would be ν . The required relationship between these frequencies is
- a) $\nu = \nu_1 + \nu_2 + \nu_3$
b) $\frac{1}{\nu} = \frac{1}{\nu_1} + \frac{1}{\nu_2} + \frac{1}{\nu_3}$
c) $\nu = \frac{\nu_1 + \nu_2 + \nu_3}{3}$
d) $\nu^{1/2} = \nu_1^{1/2} + \nu_2^{1/2} + \nu_3^{1/2}$
5. Two particles execute simple harmonic motion of same amplitude and frequency along the same straight line. They pass each other when going in opposite directions, and each time their displacement is half of their amplitude. The phase difference between them is
- a) 60° b) 90° c) 120° d) 135°
-

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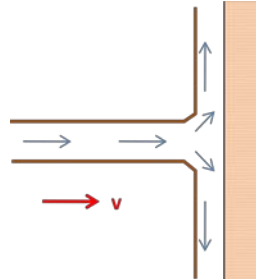
6. At the instant $t = 0$, a particle starts moving due to a force $F = F_0 \sin \omega t$, where F_0, ω are constants. Which one of the following plots gives the relation between the distance (s) covered by the particle and ωt ?



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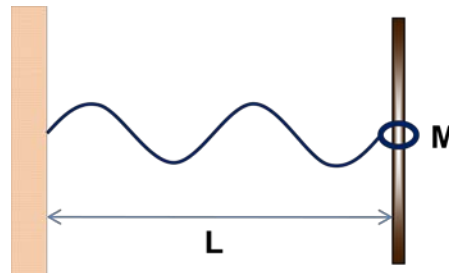
7. A stream of water of density ρ , cross-section A and speed v strikes a wall that is perpendicular to the stream as shown. The water then flows sideways along the wall. The force exerted by the stream on the wall is

- a) $\rho v^2 A$
b) $\rho v^2 A / 2$
c) $\rho v^2 A / 4$
d) $\rho v^2 A / 8$



8. A small amplitude standing wave of wavelength λ occurs on a string of with tension T , mass per unit length μ , and length L . one end of string is fixed and the other end is attached to a ring of mass M that slides on a frictionless rod, as shown in the figure. Consider extreme cases of M . When gravity is neglected, which of the following conditions correctly determines the wavelength?

- a) $\frac{\mu}{M} = \frac{2\pi}{\lambda} \cot\left(\frac{2\pi L}{\lambda}\right)$
b) $\frac{\mu}{M} = \frac{2\pi}{\lambda} \tan\left(\frac{2\pi L}{\lambda}\right)$
c) $\frac{\mu}{M} = \frac{2\pi}{\lambda} \sin\left(\frac{2\pi L}{\lambda}\right)$
d) None of these



9. Two identical rectangular strips, one of copper and the other of steel, are riveted together to form a bimetallic strip ($\alpha_{\text{copper}} > \alpha_{\text{steel}}$). On heating, this strip will
- a) remain straight
b) bend with copper on convex side
c) bend with steel on convex side
d) get twisted

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SECTION II

ASSERTION-REASON TYPE

This question contains 4 reasoning type questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer. NO MARKS WILL BE GIVEN OR DEDUCTED IF A QUESTION IS NOT ANSWERED.

10. Statement 1: Holes become smaller when heated.

Statement 2: When an object's temperature is raised, every linear dimension increases in size.

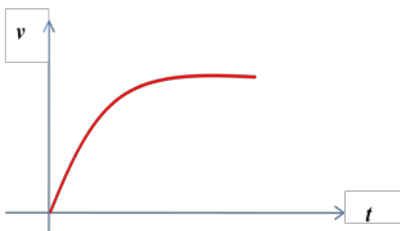
- (a) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
- (b) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
- (c) STATEMENT-1 is True, STATEMENT-2 is False
- (d) STATEMENT-1 is False, STATEMENT-2 is true

11. Statement 1: Standing in the sun is more pleasant on a cold winter day than standing in shade.

Statement 2: The temperature of air in the sun is considerably higher than that of air in the shade.

- (a) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
- (b) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
- (c) STATEMENT-1 is True, STATEMENT-2 is False
- (d) STATEMENT-1 is False, STATEMENT-2 is true

12. Statement 1: The given figure represents the velocity-time (v - t) graph of a small spherical body falling in a viscous fluid.



Statement 2: Initially the body is accelerated in the fluid. After falling a certain distance, the viscous force and upthrust balance the weight of the body. Then, the net force acting on the body becomes zero and it falls with a constant velocity.

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- (a) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
- (b) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
- (c) STATEMENT-1 is True, STATEMENT-2 is False
- (d) STATEMENT-1 is False, STATEMENT-2 is true

13. The space between two large horizontal metal plates, 6 cm apart, is filled with a liquid of viscosity $0.8 \text{ N}\cdot\text{s}/\text{m}^2$. A thin plate of surface area 0.01 m^2 is moved parallel to the length of the plate such that plate is at a distance of 2 cm from one of the plates and 4 cm from the other. Consider the given statements based on this passage.

Statement 1: If the plate moves with a constant speed of 1 m/s, then the layer of fluid which is in contact with the moving plate is having the maximum velocity.

Statement 2: The velocity of the layer of fluid which is in contact with fixed metal plates is zero and as we move towards the centre from either plate, the velocity of the layer of fluid increases and it becomes maximum at the location of moving plate, this maximum value is same as that of the velocity of plate.

- (a) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
- (b) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
- (c) STATEMENT-1 is True, STATEMENT-2 is False
- (d) STATEMENT-1 is False, STATEMENT-2 is true

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SECTION III

LINKED COMPREHENSION TYPE

This section contains 2 paragraphs. Based upon each paragraph, 3 multiple choice questions have to be answered. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 4 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer. NO MARKS WILL BE GIVEN OR DEDUCTED IF A QUESTION IS NOT ANSWERED.

Paragraph for Questions numbers 14 to 16

A pulse is started at a time $t = 0$ along positive x -axis on a long, taut string. The shape of the pulse at $t = 0$ is given by function $f(x)$ with

$$f(x) = \begin{cases} \frac{x}{4} + 1; & -4 < x \leq 0 \\ -x + 1; & 0 < x < 1 \\ 0; & \text{otherwise} \end{cases}$$

where f and x are in cm. The linear mass density of the string is 50 g/m and it is under a tension of 5 N. Answer the following questions based on this passage:

14. The shape of the string is drawn at $t = 0$ and the area of the pulse enclosed by the string and the x -axis is measured. It is equal to
a) 2 cm² b) 2.5 cm² c) 4 cm² d) 5 cm²
15. The vertical displacement of the string at $x = 7$ cm and $t = 0.001$ s will be
a) 0.75 cm b) 0.5 cm c) 0.25 cm d) zero
16. The transverse velocity of the particle at $x = 13$ cm and $t = 0.015$ s will be
a) -250 cm/s b) -500 cm/s c) 500 cm/s d) -1000 cm/s

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Paragraph for Questions numbers 17 to 19

A metal block of heat capacity $80 \text{ J/}^\circ\text{C}$ placed in a room at 20°C is heated electrically. The heater is switched off when the temperature reaches 30°C . The temperature of the block rises at the rate of 2°C/s just after the heater is switched on and falls at the rate of 2°C/s just after the heater is switched off. Assume Newton's law of cooling to hold. Answer the following questions based on this paragraph.

17. The power radiated by the block just after the heater is switched off is
a) 4 W b) 8 W c) 16 W d) 160 W
18. The power radiated by the block when the temperature of the block is 25°C is
a) 4 W b) 8 W c) 16 W d) 160 W
19. Assuming that the power radiated at 25°C represents the average value in heating process, find the time for which the heater was kept on.
a) 1.3 s b) 2.6 s c) 3.9 s d) 5.2 s

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SECTION-IV

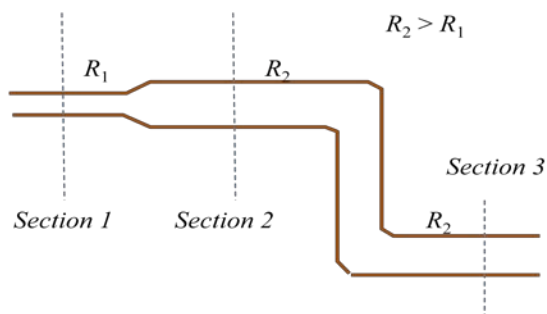
Matrix Match Type

This section contains 3 questions. Each question contains statements given in two columns which have to be matched. Statements in **Column I** are labelled as A, B, C and D whereas statements in **Column II** are labelled as p, q, r and s. The answers to these questions have to be appropriately bubbled as illustrated in the following example.

If the correct matches are A-q, A-r, B-p, B-s, C-r, C-s and D-q, then the correctly bubbled matrix will look like the following :

	p	q	r	s
A	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
B	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
C	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

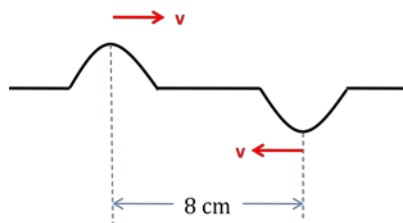
20. An arrangement of pipes is shown in the figure. The flow of water (incompressible and non-viscous) through the pipes is steady in nature. Three sections of the pipe are marked in which section 1 and 2 are at the same horizontal level, while being at a greater height than section 3. Match the Column I with Column II.



Column I		Column II	
(a)	Order of volume flow rate	(p)	$1 > 2 > 3$
(b)	Order of kinetic energy of a mass element while flowing through sections	(q)	$3 > 2 > 1$
(c)	Order of pressure in the sections	(r)	$1 > 2 = 3$
(d)	Order of low speed in the sections	(s)	$1 = 2 = 3$

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21. Two identical wave pulses are moving towards each other in a stretched string as shown in the figure. The speed of each pulse is 2 cm/s. At $t = 0$ the pulses are separated by 8 cm. Match the following.



Column I At time		Column II Total energy of the pulses	
(a)	$t = 1$ s	(p)	zero
(b)	$t = 2$ s	(q)	purely kinetic
(c)	$t = 3$ s	(r)	purely potential
(d)	$t = 4$ s	(s)	partly kinetic and partly potential

22. Given Coefficient of linear expansion of steel = $1.2 \times 10^{-5} / ^\circ\text{C}$ and Young's modulus of steel = $2.0 \times 10^{11} \text{ N/m}^2$. Match the following.

Column I		Column II	
(a)	A steel rod is clamped at its two ends and rests on a fixed horizontal base. The rod is unstrained at 20°C . The longitudinal stress (in S.I. unit) developed in the rod if the temperature rises to 50°C	(p)	3.6×10^{-4}
(b)	A steel rod of length 1 m rests on a smooth horizontal base. The longitudinal strain (in S.I. unit) developed when it is heated from 20°C to 50°C	(q)	0
(c)	A uniform steel wire of cross-sectional area 0.20 mm^2 is held fixed clamping its two ends. The extra force (in S.I. unit) exerted by each clamp on the wire if the wire is cooled from 100°C to 0°C	(r)	24
(d)	A uniform steel wire of cross-sectional area 0.5 mm^2 is held fixed clamping its two ends. If the wire is just taut at 20°C , the tension (in S.I. unit) when the temperature falls to 0°C	(s)	48



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Paper II

Mathematics Part-II

SECTION I

STRAIGHT OBJECTIVE TYPE

This section contains 9 multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer.

1. A circle is inscribed (i.e touches all four sides) into a rhombus ABCD with one angle 60 .The distance from the centre of the circle to the vertex is equal to 1. If P is any point of the circle then $[PA]^2+[PB]^2+[PC]^2+[PD]^2$ is equal to
a) 12 b)11 c)10 d)13
2. Three concentric circles of which the biggest is $x^2+y^2=1$ have their radii in AP. If the line $y=x+1$ cuts all the circles in real and distinct points. The interval in which the common difference of the AP will lie is
a) $(0,1/4)$ b) $(0, \frac{1}{2\sqrt{2}})$ c) $(0, \frac{2-\sqrt{2}}{4})$ d) None of these
3. The axes are translated so that the new eqn. of circle $x^2+y^2-8x+2y-5=0$ has no first degree terms. Then the new equation is
i) $x^2+y^2=9$ ii) $x^2+y^2=\frac{49}{4} \frac{81}{16}$ iii) $x^2+y^2=\frac{81}{16}$ iv) None of these

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4. The axes are translated so that the new eqn. of circle $x^2+y^2-8x+2y-5=0$ has no first degree terms. Then the new equation is

i) $x^2+y^2=9$

ii) $x^2+y^2=\frac{49}{4}-\frac{81}{16}$

iii) $x^2+y^2=\frac{81}{16}$

iv) None of these

5. A line meets the co-ordinate axes in A and B. A circle is circumscribed about the triangle OAB. If d_1 and d_2 are the distances of tangent to the circle at origin O from the points A and B respectively, then diameter of circle is

i) $\frac{2d_1+d_2}{2}$

ii) $\frac{d_1+2d_2}{2}$

iii) d_1+d_2

iv) $\frac{d_1d_2}{d_1+d_2}$

6. The sides a,b,c of a triangle ABC are roots of $x^3-11x^2+38x-40=0$ then $\sum \frac{\cos A}{a} =$

i) $\frac{3}{4}$

ii) 1

iii) $\frac{9}{16}$

iv) None of these

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7. If the angles A,B,C of the triangle ABC be in A.P, then $\frac{c}{a+b} \frac{a+c}{\sqrt{a^2-ac+c^2}} =$

i) $2\cos \frac{A+C}{2}$ ii) $2 \sin \frac{A+C}{2}$ iii) $2\cos \frac{A-C}{2}$ iv) $2 \sin \frac{A-C}{2}$

8. If $A = 60^\circ$, then $\frac{b}{c+a} + \frac{c}{a+b} =$

i) 0 ii) 1 iii) s iv) S

9. In a triangle ABC . $\frac{a \sin B + b \sin A}{\sqrt{\sin A \sin B}} = 4$, $\angle C = \pi/3$, then $a^2+b^2-c^2 =$

i) 4 ii)6 iii)8 iv)10

SPACE FOR ROUGH WORK

SECTION II

MULTIPLE CHOICE TYPE QUESTIONS

This section contains 6 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE is correct. NO NEGATIVE marking.

10. The centre of a circle passing through the point $(0,0)$, $(1,0)$ and lying on the circle $x^2+y^2=9$ is

- i) $(3/2, 1/2)$ ii) $(1/2, \sqrt{2})$ iii) $(1/2, 1/2)$ iv) $(1/2, -\sqrt{2})$

11. If $al^2 - bm^2 + 2dl + 1 = 0$, where a, b, d are fixed real number such that $a + b + d = 2$, then the line $lx + my + 1 = 0$ touches the fixed circle

- i) which cuts the x-axis orthogonally
ii) with radii equal to 6
iii) on which the length of tangent from origin is $\sqrt{2} \sqrt{d^2 - b}$
iv) None of these

12. The solution set of inequality $\log_{10}(x^2 - 16) \leq \log_{10}(4x - 11)$

- i) $(3, 5]$ ii) $(4, 5]$ iii) $(5, 5]$ iv) None of these

13. The locus of the mid points of the chords of the circle $x^2 - 2x - 2y + 1 = 0$ which are of unit length is

- i) $(x - 1)^2 + (y - 1)^2 = 3/4$
ii) $(x - 1)^2 + (y - 1)^2 = 2$
iii) $(x - 1)^2 + (y - 1)^2 = 4$
iv) none of these
-

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SECTION III

LINKED COMPREHENSION TYPE

This section contains 2 paragraphs. Based upon each paragraph, 3 multiple choice questions have to be answered. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 4 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer. NO MARKS WILL BE GIVEN OR DEDUCTED IF A QUESTION IS NOT ANSWERED.

Paragraph for Questions numbers 14 to 16

Let a and b length of the legs of a right angled triangle with following properties.

All the three sides of the triangle are integers.

The perimeter of triangle is numerically equal to the area of the triangle, it is given that $a < b$.

Based on this passage, answer the following questions.

14. The number of ordered pairs (a, b) will be

- (a) 1 (b) 2 (c) 29 (d) 4

15. Maximum possible perimeter of the triangle is

- (a) 27 (b) 28 (c) 29 (d) 30

16. Minimum possible area of the triangle

- (a) 24 (b) 25 (c) 26 (d) 27

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Paragraph for Questions numbers 17 to 19

Consider a DOAB formed by points $O(0, 0)$, $A(2, 0)$, $B(1, \sqrt{3})$. $P(x, y)$ is an arbitrary interior point of the triangle, moving in such a way that $d(P, OA) + d(P, PB) + d(P, AB) = \sqrt{3}$ where $d(P, OA)$, $d(P, PB)$, $d(P, AB)$ represent the distance of P from sides OA , AB and OB respectively.

17. Area of region representing all possible position of P is equal to

- (a) $2\sqrt{3}$ (b) $\sqrt{6}$ (c) $\sqrt{3}$ (d) none of these

18. If point P moves in such a way that $d(P, OA) \leq \min\{d(P, OB), d(P, AB)\}$ then area of the region representing all possible positions of the point P

- (a) $\sqrt{3}$ (b) $\sqrt{6}$ (c) $1/\sqrt{3}$ (d) $1/\sqrt{6}$

19. If point P moves in such a way that $d(P, OA) \geq \min\{d(P, OB), d(P, AB)\}$ then area of the region representing all possible positions of the point P

- (a) $\sqrt{3}$ (b) $\sqrt{6}$ (c) $1/\sqrt{3}$ (d) $1/\sqrt{6}$

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SECTION-IV

Matrix Match Type

This section contains 3 questions. Each question contains statements given in two columns which have to be matched. Statements in **Column I** are labelled as A, B, C and D whereas statements in **Column II** are labelled as p, q, r and s. The answers to these questions have to be appropriately bubbled as illustrated in the following example.

If the correct matches are A-q, A-r, B-p, B-s, C-r, C-s and D-q, then the correctly bubbled matrix will look like the following :

	p	q	r	s
A	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
B	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
C	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. Let us consider the equation $a^x = a^y$. Match Column I with Column II.

	Column I		Column II
(a)	$a = 1$	(p)	x and y can be any integer
(b)	$a = -1$	(q)	x and y can be any even integer
(c)	$a = 0$	(r)	x and y can be any real number
(d)	$a = \text{undefined}$	(s)	$x = y$

21. Match Column I with Column II

	Column I		Column II
(a)	The value of $\tan(\cos^{-1}\frac{4}{5} + \tan^{-1}\frac{2}{3})$ is	(p)	17/6
(b)	The numerical value of $\tan(2\tan^{-1}\frac{1}{5} - \frac{\pi}{4})$ is	(q)	-7/17
(c)	The value of $\cos(\frac{1}{2}\cos^{-1}\frac{1}{3})$ is	(r)	3/4
(d)	The value of $\operatorname{csc}^{-1}\operatorname{sincot}^{-1}(1/2)$ is	(s)	$\frac{\sqrt{5}}{3}$

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22. Match Column I with Column II

	Column I		Column II
(a)	$\sin^{-1}x - \cos^{-1}x$ is maximum at	(p)	$x = \frac{1}{\sqrt{2}}$
(b)	$(\sin^{-1}x)^2 - (\cos^{-1}x)^2$ is minimum at	(q)	$x = 1$
(c)	$(\tan^{-1}x)^2 - (\cot^{-1}x)^2$ is minimum at	(r)	$x = -1$
(d)	$(\sin^{-1}x)^3 - (\cos^{-1}x)^3$ is maximum at	(s)	$x = 0$

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Paper II

Chemistry Part-II

SECTION I

STRAIGHT OBJECTIVE TYPE

This section contains 9 multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer.

- Which of the following statement is true ?
 - BF_3 does not undergo complete hydrolysis due to formation of $\text{H}^+[\text{BF}_3\text{OH}]^-$
 - BBr_3 does not undergo hydrolysis at all because it does not form, hydrogen bond with water
 - $[\text{H}_2\text{BO}_3]^-$ is the conjugate base of H_3BO_3
 - BF_3 does not react with ether
- A solution containing 1.23g of $\text{Ca}(\text{NO}_3)_2$ in 100g of water boils at 100.975°C . The percentage ionization of nitrate ($K_b = 0.52$) is :
 - 80
 - 75
 - 65
 - 100
- A radioactive element A disintegrates in the following manner
$$A \xrightarrow{-\alpha} B \xrightarrow{-\beta} C \xrightarrow{-\beta} D$$
 - A & D are isotopes
 - B, C, D are isobars.
 - A & D are isobars and B, C, D are isotopes.
 - Both A & B.
- Borax when heated on platinum wire forms a glass like bead which is made up of :
 - Sodium tetra borate
 - sodium metaborate
 - Sodium metaborate and boric anhydride
 - Boric anhydride and sodium tetra borate

5. Which of the following is wrong ?
- (a) KO_2 is a better oxidant than K_2O_2 as it gives O_2 and H_2O_2 either in acidic or neutral medium.
(b) KO_2 is used in space capsules, submarines, and breathing masks
(c) KO_2 is colourless.
(d) KO_2 has bond order of 1.5
6. The HCP and CCP structure for a given element would be expected to have:
- (1) Same co-ordination number
(2) Same density
(3) Same packing fraction
(4) same chemical property
- (a) 1, 2, 3,4 (b) 1, 2, 3 only (c) 1, 3, 4 only (d) 2, 3, 4 only
7. Two liquids A & B have vapour pressure in the ratio $P_A^0 : P_B^0 = 2:3$ at a certain temperature .Assume A & B form an ideal solution and the ratio of mole fraction of A to B in the vapour phase is 1 :3 . then the mole fraction of A in the solution at the same temperature is :
- (a) 1/3 (b) 2/3 (c) 1/4 (d) 3/4
8. The mean lives of a radioactive sample are 30 years and 60 years for α -emission and β - emission respectively. If the sample decays both by α -emission and β - emission simultaneously, the time after which, only one fourth of the sample remains is
- (a) 10 years (b) 20 years (c) 40 years (d) 45 years
9. The wavelength of K_α X-rays for lead isotopes Pb^{208} , Pb^{206} , Pb^{204} are λ_1 , λ_2 , λ_3 respectively . Then :
- (a) $\lambda_1 \neq \lambda_2 = \lambda_3$ (b) $\lambda_1 > \lambda_2 > \lambda_3$ (c) $\lambda_1 < \lambda_2 < \lambda_3$ (d) $\lambda_2 = \sqrt{\lambda_1 \lambda_3}$

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SECTION II

ASSERTION-REASON TYPE

This question contains 4 reasoning type questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer. NO MARKS WILL BE GIVEN OR DEDUCTED IF A QUESTION IS NOT ANSWERED.

10. Statement 1: BeF_2 cannot be prepared by action of HF on $\text{Be}(\text{OH})_2$
Statement 2: HF is a weak acid and $\text{Be}(\text{OH})_2$ is a weak base. So they don't react at all.
- STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
 - STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
 - STATEMENT-1 is True, STATEMENT-2 is False
 - STATEMENT-1 is False, STATEMENT-2 is true
11. Statement 1 : NaCl type crystall changes to CsCl type crystall at high pressure and low temperature.
Statement 2: On increasing pressure and decreasing temperature coordination number of ion decreases.
- STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
 - STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
 - STATEMENT-1 is True, STATEMENT-2 is False
 - STATEMENT-1 is False, STATEMENT-2 is true
12. Statement 1: Ethylene glycol is used as antifreeze because addition of ethylene glycol to water lowers the freezing point of water.
Statement 2: Ethylene glycol forms hydrogen bond with water molecules .therefore the vapour pressure of solution is lowered.
- STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
 - STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
 - STATEMENT-1 is True, STATEMENT-2 is False
 - STATEMENT-1 is False, STATEMENT-2 is true

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13. Statement 1: The nuclear energy can be obtained by the nuclear fission of heavier nuclei as well as nuclear fission of lighter nuclei.
Statement 2: The binding energy per nucleon with increase in atomic number first increase and then decrease
- STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
 - STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
 - STATEMENT-1 is True, STATEMENT-2 is False
 - STATEMENT-1 is False, STATEMENT-2 is true

SECTION III

LINKED COMPREHENSION TYPE

This section contains 2 paragraphs. Based upon each paragraph, 3 multiple choice questions have to be answered. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 4 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer. NO MARKS WILL BE GIVEN OR DEDUCTED IF A QUESTION IS NOT ANSWERED.

Paragraph for Questions numbers 14 to 16

Element (A) burns in nitrogen atmosphere to give an ionic compound (B). Compound (B) gets hydrolysed by water giving compound (C) and (D). A solution of (c) becomes milky on passing carbon dioxide through it. Element (A) reacts quite readily with cold water liberating hydrogen gas and forming metal hydroxide .

14. Select the correct statement with respect to (D)
- It is trigonal pyramidal in shape.
 - It can be obtained by the hydrolysis of calcium Cyanamid , $\text{Ca}(\text{OH})_2$
 - It gives white precipitate with HgCl_2
 - All of these
15. The compound (C) is
- (a) $\text{Mg}(\text{OH})_2$ (b) $\text{Ba}(\text{OH})_2$ (C) $\text{Ca}(\text{OH})_2$ (d) (B) and (C) both

16. Which of the following statement is incorrect ?

- (a) Chloride of (A) imparts characteristic colour to the Bunsen burner flame.
- (b) Chloride of (A) does not impart any characteristic colour to the Bunsen burner flame.
- (c) Compound (C) is basic in nature.
- (d) Aqueous solution of compound (D) produces deep blue coloration with CuSO_4 solution .

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Paragraph for Questions numbers 17 to 19

The structure of ZnS is called the zinc blende structure. In this structure S^{2-} ions form the FCC lattice and Zn^{+2} ions occupy the alternate tetrahedral voids. Considering this structure answer the following question:

17. If A^+B^- has got the structure similar to ZnS and the edge length of the solid AB is 4Å ; then find the distance between A^+ and B^- ions :
(a) $\sqrt{3}\text{Å}$ (b) $(\sqrt{3}/\sqrt{2})\text{Å}$ (c) 4Å (d) $\sqrt{2}\text{Å}$
18. In this solid A^+B^- is modified by adding C^+ in half of the vacant tetrahedral voids such that the electrical neutrality is maintained without adding any B^- ions, what is the number of the formula units of the solid per unit cell ?
(a) 2 (b) 1 (c) 4 (d) 3
19. If the solid A^+B^- is heated so that the ions along two of the axis passing through the face centre particles are lost and bivalent ion (Z) enters here to maintain the electrical neutrality. What will be the formula unit of the new unit cell ?
(a) A_4B_4Z (b) $A_3B_4Z_2$ (c) $A_6B_8Z_2$ (d) A_4B_8Z

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SECTION-IV

Matrix Match Type

This section contains 3 questions. Each question contains statements given in two columns which have to be matched. Statements in **Column I** are labelled as A, B, C and D whereas statements in **Column II** are labelled as p, q, r and s. The answers to these questions have to be appropriately bubbled as illustrated in the following example.

If the correct matches are A-q, A-r, B-p, B-s, C-r, C-s and D-q, then the correctly bubbled matrix will look like the following :

	p	q	r	s
A	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
B	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
C	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. Match the following

Column I	Column II
(a) Spontaneous radioactive decay of an uranium nucleus initially at rest as given by reaction $^{238}\text{U}_{92} \rightarrow ^{234}\text{Th}_{90} + ^4\text{He}_2 + \dots$	(p) Number of proton is increased
(b) fusion reaction of two hydrogen nuclei as given by reaction $^1\text{H}_1 + ^1\text{H}_1 \rightarrow ^2\text{H}_1 + \dots$	(q) Momentum is conserved
(c) fission of U^{235} nucleus initiated by a thermal neutron as given by reaction $^1_0\text{n} + ^{238}\text{U}_{92} \rightarrow ^{144}\text{Ba}_{56} + ^{89}\text{Kr}_{36} + 3^1_0\text{n} + \dots$	(r) Mass is converted to energy or vice-versa
(d) β^- decay (negative beta decay)	(s) charge is conserved

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21. Match column I with column II

Column I	Column II
a Lyophobic colloid	p Irreversible behaviour
b Chemical adsorption	q Temperature dependent
c Enzymatic activity	r Temperature dependent
d Dialysis	s $\text{Fe}(\text{OH})_3$

22. Match the following

Column I	Column II
(a) $\text{PCl}_5 \xrightarrow{\text{moist air}}$	(p) Hydrolysis
(b) $\text{P}_4 + \text{NaOH}(\text{Conc.}) + \text{H}_2\text{O} \xrightarrow{\text{Warm}}$	(q) At least one of the product has tetrahedral hybridisation
(c) $\text{H}_3\text{PO}_3 \xrightarrow{\Delta}$	(r) Disproportionation
(d) $\text{P}_4\text{O}_6 + \text{H}_2\text{O} \xrightarrow{\Delta}$	(s) At least one of the product has $\text{P}\pi\text{-d}\pi$ bonding



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