FIITJEE Talent Reward Exam

for student presently in

Class 10

A

PAPER–1

Time: 3 Hours | **CODE 10A** | *Maximum Marks: 214*

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.

1. This Question Paper Consists of 7 Comprehension Passages based on Physics, Chemistry and Mathematics which has total **29 objective type questions.**
2. All the Questions are Multiple Choice Questions having only **one correct answer**. Each question from **Q. 1 to 9** carries **+6 marks** for correct answer and **–2 marks** for wrong answer. Each question from **Q. 10 to 29** carries **+8 marks** for correct answer and **–3 marks** for wrong answer.
3. Answers have to be marked on the OMR sheet.
4. The Question Paper contains blank spaces for your rough work. No additional sheets will be provided for rough work.
5. Blank papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.
6. **Before attempting paper write your Name, Registration number** and **Test Centre** in the space provided at the bottom of this sheet.

Note:

Check all the sheets of this question paper. Please ensure the same SET is marked on header of all the sheets inside as indicated above 'Maximum Marks' of this page. In case SET marked is not the same on all pages, immediately inform the invigilator and CHANGE the Questions paper.

Registration Number : ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

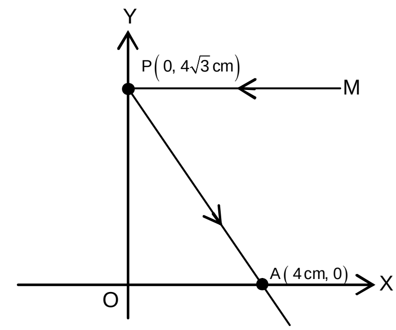
Name of the Candidate : ____________________

Test Centre : ____________________

Comprehension

COMPREHENSION – 1 (For question No. 1-3)

A plane mirror is inclined at angle θ with x-axis. The point P is on the mirror. An incident ray MP, after reflection at point P of the mirror, passes through point A as shown in the figure. Read the passage carefully and answer the following questions



1. The value of θ is
   (A) 30° (B) 45°
   (C) 60° (D) 90°

2. Now the mirror is rotated is such a way so that the incident ray MP, after reflection at point P of the mirror, pass through the origin, then
   (A) mirror must be rotated by angle 15° anticlockwise
   (B) mirror must be rotated by angle 15° clockwise
   (C) mirror must be rotated by angle 30° anticlockwise
   (D) mirror must be rotated by angle 30° clockwise

3. Which of the following optical instruments works on the principle of reflection of light from plane mirror?
   (A) magnifying glass (B) Telescope
   (C) Periscope (D) Microscope

Space for Rough Work

COMPREHENSION – 2 (For question No. 4-6)

Consider the reaction of acidified potassium permanganate with sodium sulphite as follows:

$MnO_4^- + H^+ + SO_3^{2-} \longrightarrow Mn^{2+} + SO_4^{2-} + H_2O$

It is a redox reaction in which one species is getting oxidized by losing electron/s and other is getting reduced by gaining electron/s.

The number of electrons which the atom of an element loses or gains in going from its free elemental state (which is 0) to its new state in that particular compound is called the Oxidation Number (O.N.) of the element in that compound.

The oxidation number of an element in a compound is determined by the algebraic sum of oxidation numbers of the individual atoms, each multiplied by the number of atoms of the element in the molecule which is = 0 (in case of a compound) and for an ion is equal to the charge present. For example the algebraic sum of O.N. of atoms in H_2O is shown as below :

(oxidation number of oxygen is generally –2, O.N. of hydrogen = +1)

H_2O

$(+1) \times 2 + (-2) = 0$

The substance which undergoes reduction is called an oxidant and that which undergoes oxidation is called a reductant.

Answer the following questions:

4. Which species is getting reduced in the above reaction?

(A) MnO_4^- (B) H^+
(C) SO_3^{2-} (D) Mn^{2+}

5. Which species is acting as a reductant?

(A) MnO_4^- (B) H^+
(C) SO_3^{2-} (D) Mn^{2+}

6. If equivalent weight = $\dfrac{\text{Molecular weight}}{\text{Valence factor}}$

where valence factor = no. of electrons lost or gained by one molecule of reductant or oxidant in a reaction and is calculated by taking the difference of O. N. of that element in the reactant & the product. It is always positive.

What will be the equivalent weight of $KMnO_4$ in the above reaction?

(At. Mass K = 39; Mn = 55; O =16)

(A) 158 (B) 79
(C) 39.5 (D) 31.6

Space for Rough Work

COMPREHENSION – 3 (For question No. 7-9)

HCF of natural numbers is the largest factor which is common to all the numbers and LCM of natural numbers is the smallest natural number which is multiple of all the numbers.

7. If p and q are two co-prime natural numbers, then their H.C.F. is equal to
   (A) p (B) q
   (C) 1 (D) pq

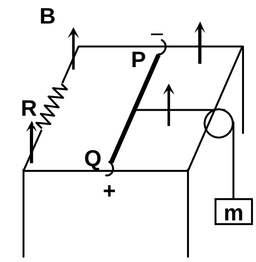
8. The L.C.M. and H.C.F. of two rational numbers are equal, then the numbers must be
   (A) prime (B) co-prime
   (C) composite (D) equal

9. If two positive integers a and b are expressible in the form $a = pq^2$ and $b = p^3q$; p, q being prime numbers, then L.C.M. (a, b) is
   (A) pq (B) p^3q^3
   (C) p^3q^2 (D) p^2q^2

Space for Rough Work

COMPREHENSION – 4 (For question No. 10-14)

An electrical circuit is formed by connecting a resistance R with two parallel conducting rods at its both ends and kept on a horizontal table. A sliding wire PQ of length ℓ and mass m can slide over the parallel conducting rods without friction. This wire PQ is connected to a block of mass m through an insulating string going over a smooth non-conducting pulley as shown. Initially system is at rest. A vertical magnetic field B is switched on and wire PQ is allowed to move.



It is known that emf is induced in the wire PQ when it is moved forward, given by $vB\ell$ where v is the velocity of the wire PQ, B is the magnetic field and ℓ is the length of the wire PQ. Polarity of the emf is as shown in the figure. When emf is induced current in the circuit is also induced, and a magnetic force acts on the wire PQ in the backward direction of motion and is given by $F_m = i\ell B$ where i is the induced current. Under the influence of magnetic force and tension in the string, wire PQ attains a constant velocity v_0 (also called terminal velocity).
(Given B = $\sqrt{10}$T , ℓ = 1 m, v_0 = 10 m/s, R = 10Ω, g = 10 m/s^2)

10. SI unit of $\frac{iB\ell}{g}$ is
(A) N (B) N/m^2
(C) kg (D) kg/m^2

11. The current flowing through resistance when wire PQ attains constant velocity v_0 is
(A) $10\sqrt{10}$ A (B) $5\sqrt{10}$ A
(C) $\sqrt{10}$ A (D) 5 A

12. The value of mass m is
(A) 2 kg (B) 0.5 kg
(C) 1 kg (D) 1.5 kg

13. Tension in the string when wire PQ attains constant velocity v_0 is
(A) 10 N (B) 20 N
(C) 30 N (D) 40 N

14. If we replace hanging mass m by 3m and length of wire PQ is doubled keeping all other parameters same, the new terminal velocity will be
(A) 10 m/s (B) 7.5 m/s
(C) 5 m/s (D) 2.5 m/s

Space for Rough Work

COMPREHENSION – 5 (For question No. 15-19)

A new way of expressing the concentration of H^+ ions in solution is pH. pH is defined as the negative logarithm to base 10 of H^+ ion concentration.

$pH = -\log_{10}[H^+]$, where $[H^+]$ represent the concentration of H^+ ions in moles per litre.

Pure water is considered neutral as it dissociates to give equal concentration of H^+ and OH^- ions as follows $H_2O \rightleftharpoons H^+ + OH^-$.
$[H^+] = [OH^-] = 10^{-7}$ moles per litre at 25°C.
As per the formula, $pH = -\log_{10}(10^{-7}) = 7$, hence pH of water is 7.
K_w is the ionic product of water which is equal to product of H^+ and OH^- concentration at a particular temperature.
At 25°C, $K_w = [H^+] . [OH^-] = 10^{-14}$ mol^2/L^2.
Hence, pH + pOH = 14 (only at 25°C).
For an acidic solution $[H^+] > [OH^-]$ which is numerically greater than 10^{-7} mol ion / litre (at 25°C).
Lower the pH value, greater will be the acidic strength of the solution.
For a basic solution $[H^+] < [OH^-]$ which is numerically less than 10^{-7} mol ion / litre. Thus, pH of a base is always greater than 7 at 25°C.
Greater the pH value greater will be the basic strength of the solution.
(log 10 = 1 ; log 0.1 = – 1; log 100 = 2)

15. You are provided with four solutions P, Q, R, S with $[H^+]$ values (in mol/litre) as 1.076×10^{-13}, 1.89×10^{-12}, 3.2×10^{-10} and 2.7×10^{-11} respectively. Which solution will be most acidic?
(A) P (B) Q
(C) R (D) S

16. At 60°C, if water has $[H^+] = 10^{-5}$ mol/litre, then the solution will be
(A) Acidic (B) Basic
(C) Amphoteric (D) Neutral

17. Now if 3.65 gm of HCl is added to 1 litre of water (as mentioned in Q. No. 16). What will be the pH of resultant solution at 60°C (atomic weight of Cl = 35.5, H = 1)?
(A) 0.01 (B) 0.1
(C) 1 (D) 10

18. What will be the pOH of the resultant solution (in Q. No. 17)?
(A) 13 (B) 10
(C) 9 (D) 7

19. What will be the pH of the resultant solution if 1 litre of 10^{-1} M NaOH solution is added to the solution in Q. No. 17?
(A) 7 (B) 1
(C) 3 (D) 5

Space for Rough Work

COMPREHENSION – 6 (For question No. 20-24)

A number ABCD can be written as $1 \times D + 10 \times C + 100 \times B + 1000 \times A$. Also, $x = \alpha$ and $y = \beta$ is the solution of the system of equations:

$a_1x + b_1y + c_1 = 0$ … (1)

$a_2x + b_2y + c_2 = 0$ … (2)

if $x = \alpha$ and $y = \beta$ satisfy both the equations (1) and (2)

20. Sum of digits of a two-digit number is 7 and the number increases by 9 if the digits are interchanged, then the number is equal to

(A) 25 (B) 43
(C) 61 (D) 34

21. A boat can row 20 km downstream in 2 hours and return in two and half hours, then the speed of the stream is equal to

(A) 9 km/h (B) 8 km/h
(C) 2 km/h (D) 1 km/h

22. The lines $2x + y + 3 = 0$ and $3x + ky + \frac{9}{2} = 0$ coincide for k equal to

(A) 1/2 (B) 1
(C) 3/2 (D) 1

23. Given that $2^x = 8^{y+1}$ and $9^y = 3^{x-9}$, the value of x + y is

(A) 18 (B) 21
(C) 24 (D) 27

24. X takes 3 hours more than Y to walk 30 km. But, if X doubles his pace, he is ahead of Y by $1\frac{1}{2}$ hrs. The speed of Y in km/h is

(A) $\frac{10}{3}$ (B) 5
(C) 3 (D) $\frac{20}{3}$

Space for Rough Work

COMPREHENSION – 7 (For question No. 25-29)

Let $f(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \ldots + a_0$, where $a_n \neq 0$, $n \in N$ is a polynomial of degree n.
When f(x) is divided by $(x - \alpha)$, then remainder is $f(\alpha)$.
If $f(\alpha) = 0$, then $(x - \alpha)$ is a factor of f(x) and $x = \alpha$ is the root of the equation $f(x) = 0$

25. On dividing $2x^2 + 3x + 1$ by a polynomial g (x), the quotient is $2x - 1$ and remainder is 'r', where $r \in R$, then g (x) is
    (A) $x - 1$ (B) $x + 1$
    (C) $x + 2$ (D) $x + 4$

26. The remainder 'r' when $2x^2 + 3x + 1$ is divided by g (x) and quotient is $2x - 1$, is
    (A) 0 (B) 1
    (C) 2 (D) 3

27. Let $f(x) = x^5 + ax^4 + bx^3 + cx^2 + d$ such that f (1) = 1, f (2) = 2, f (3) = 3, f (4) = 4 and f (5) = 5, then the value of d is
    (A) – 120 (B) – 100
    (C) 0 (D) 100

28. Let f (x) is a 3rd degree polynomial such that $f(x^2) = 0$ has exactly four distinct real roots, then
    (A) f (x) = 0 has all three real roots (B) f (x) = 0 has exactly 2 real roots
    (C) f (x) = 0 has only one real root (D) none of these

29. In the above question, if f (k) = 0, $k \neq \alpha^2, \beta^2$ (where $\pm\alpha, \pm\beta$ are the roots of equation $f(x^2) = 0$), then
    (A) $k < 0$ (B) $k > 0$
    (C) $k \leq 0$ (D) $k \geq 0$

Space for Rough Work

FIITJEE TALENT REWARD EXAM

(FTRE-2013)

CLASS X
HINTS (SET-A)
PAPER-1

1. Let $\angle PAO = \gamma$

$\tan\gamma = \frac{4\sqrt{3}}{4} \Rightarrow \gamma = 60°$

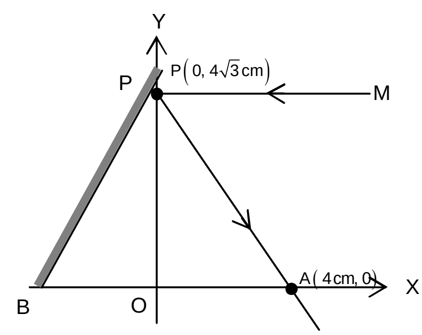
$\angle APO = 30°$

$\angle BPO = 90° - \theta$

$90° - \theta + 30° = \theta$

$\Rightarrow\ 2\theta = 120°$

$\Rightarrow\ \theta = 60°$



2. As the reflected ray is rotated 30° clockwise, so the mirror should be rotated by angle 15° clockwise.

3. The instrument which works on the principle of reflection of light from plane mirror is periscope.

4. Oxidation Number of Mn in MnO_4^- = +7 while that in Mn^{2+} = +2. Since there is a decrease in oxidation no. hence MnO_4^- is reduced.

5. Reducing agent is the one which itself gets oxidized in the reaction.

6. mol. wt. of $KMnO_4 = 158$

Valence factor = 5

$\therefore$ eq. wt. = $\frac{158}{5} = 31.6$

7. H.C.F. of two co-prime natural numbers is 1

8. L.CM. = H.CF.

$\Rightarrow$ two numbers are equal.

9. Clearly, L.CM. = (L.C.M. of p and p^3) (L.C.M. of q^2 and q) = p^3q^2

10-14. Since velocity is constant, $F_{net} = 0 \Rightarrow$ mg = iℓB = $\frac{B^2\ell^2 v_0}{R}$ $\left[\because i = \frac{\varepsilon}{R} = \frac{B\ell v_0}{R}\right]$

on solving we get, m = 1kg

15. R has highest value of $[H^+]$.

16. Irrespective of temperature, water will dissociate into equal amount of H^+ & OH^-.

17. Molarity of HCl = $\frac{3.65}{36.5 \times 1} = 0.1$

$\therefore$ pH = – log (0.1) = 1

18. pH + pOH = 10

pOH = 10 – 1 = 9.

19. Moles of HCl = 0.1

Moles of NaOH = 0.1

Since moles of HCl = Moles of NaOH

They will neutralize each other completely.

20. Let the digit at unit's place be x and ten's place be y.

x + y = 7 … (1)

10x + y = 10y + x + 9

$\Rightarrow$ 9 (x – y) = 9

$\Rightarrow$ x – y = 1. … (2)

From equation (1) and (2), we get

x = 4, y = 3

$\therefore$ The required number = 34.

21. Let the speed of the boat be x km/hr, stream be y km/hr

$\therefore$ (x + y) $\times$ 2 = 20

$\Rightarrow$ x + y = 10 ... (1)

(x – y) $\times \frac{5}{2}$ = 20

$\Rightarrow$ x – y = 8 … (2)

From (1) and (2), we get

$\therefore$ y = 1.

22. $\frac{3}{2} = \frac{k}{1}$

$\therefore$ k = $\frac{3}{2}$.

23. x = 3y + 3 … (1)

2y = x – 9

$\Rightarrow$ x = 2y + 9 … (2)

From equation (1) and (2), we get

3y + 3 = 2y + 9

$\therefore$ y = 6 and x = 21.

24. $\frac{30}{x} = \frac{30}{y} + 3$ … (1)

$\frac{30}{2x} = \frac{30}{y} - \frac{3}{2}$ … (2)

From (1) and (2), we get
y = 5km/hr.

25. Let f (x) = $2x^2 + 3x + 1 = (2x - 1)\, g(x) + r$, where g (x) is a quotient
$\Rightarrow g(x) = x + 2$.

26. By remainder theorem $r = f(-2) = 2(-2)^2 + 3(-2) + 1$
$= 8 - 6 + 1 = 3$.

27. $f(x) - x = (x - 1)(x - 2)(x - 3)(x - 4)(x - 5) \Rightarrow f(0) = d = (-1)(-2)(-3)(-4)(-5)$.

28. For α^2, β^2 if $f(\alpha^2) = 0 = f(\beta^2)$
$\Rightarrow x = \pm\alpha$, $x = \pm\beta$ are 4 distinct roots of $f(x^2) = 0$
$\Rightarrow f(x) = 0$ has α^2 and β^2 as real roots
$\Rightarrow f(x) = 0$ has all three real roots.

29. If k > 0, then $f(x^2) = 0$ has exactly 6 distinct real roots.