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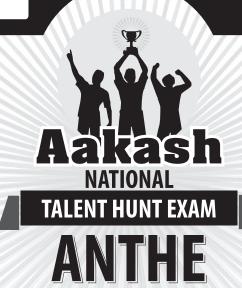
Booklet Code E



Name:

Date: 16th December 2020

ENGINEERING



(Class XII Studying moving to XII Passed)

-2020

Physics, Chemistry & Mathematics

INSTRUCTIONS FOR CANDIDATE

- 1. Duration of Test is 1 hr.
- 2. The Test booklet consists of 35 questions. The maximum marks are 90. There is no negative marking for wrong
- 3. Pattern of the questions are as under:
 - This question paper consists of three parts i.e., Physics, Chemistry and Mathematics, each having five sections.
 - Section-I: This section contains 16 multiple choice questions, which have only one correct answer. Each question carries **+2 marks** for correct answer.
 - (iii) Section-II: This section contains 7 multiple choice questions, in which more than one answer may be correct. Each question carries +4 marks for correct answer.

- (iv) Section-III: This section contains 6 multiple choice questions based on paragraphs, which have only one correct answer. Each question carries +2 marks for correct answer.
- (v) Section-IV: This section contains 3 multiple choice questions based on assertion-reason type, which have only one correct answer. Each question carries +2 marks for correct answer.
- (vi) Section-V: This section contains 3 matrix match type questions. Each question has two matching Columns. Column-I has four entries (A, B, C, D) and Column-II has four entries (P, Q, R, S). Each entry in Column-I may match with one or more entries in Column-II. Each question carries +4 marks for correct answer.



(Divisions of Aakash Educational Services Limited)

Aakash National Talent Hunt Exam 2020

(For Class XII Studying moving to XII Passed)

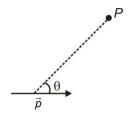
Time: 1 Hour MM: 90

PHYSICS

SECTION-I: SINGLE ANSWER TYPE

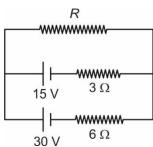
This section contains 5 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

1. Value of angle θ for which electric field at point P is perpendicular to dipole moment \vec{p} is



- (1) $tan^{-1}(2)$
- (3) $\tan^{-1}(\sqrt{2})$

- $(2) \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$
- (4) $tan^{-1}(1)$
- 2. If value of resistor R is adjusted in such a way that power dissipated to resistor R is maximum equal to P_0 , then



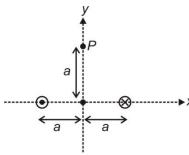
(1) $R = 2 \Omega$, $P_0 = 100 \text{ W}$

(2) $R = 2 \Omega$, $P_0 = 50 \text{ W}$

(3) $R = 3 \Omega$, $P_0 = 100 \text{ W}$

(4) $R = 6 \Omega$, $P_0 = 50 \text{ W}$

3. Current I flows along the two long wires as shown in figure. Magnetic field at point P is

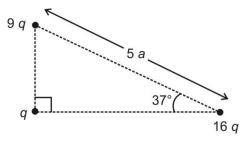


(1) $\frac{\mu_0 I}{4\pi a}$

 $(2) \quad \frac{\mu_0 I}{2\pi a}$

 $(3) \quad \frac{\mu_0 I}{2\sqrt{2}\pi a}$

- $(4) \quad \frac{\mu_0 I}{\sqrt{2}\pi a}$
- 4. Three point charges are placed on the vertices of a right angled triangled as shown. Force acting on the point charge q is

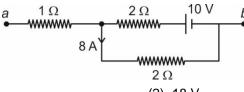


 $(1) \quad \frac{q^2}{2\pi\varepsilon_0 a^2}$

 $(2) \quad \frac{q^2}{4\sqrt{2}\pi\varepsilon_0 a^2}$

 $(3) \quad \frac{q^2}{4\pi\varepsilon_0 a^2}$

- $(4) \quad \frac{q^2}{2\sqrt{2}\pi\varepsilon_0 a^2}$
- 5. For the circuit shown, potential difference between a and b is



(1) 35 V

(2) 18 V

(3) 27 V

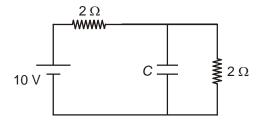
(4) 25 V

Space for Rough Work

SECTION-II: MORE THAN ONE ANSWER TYPE

This section contains 2 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which **MORE THAN ONE** answer may be correct.

6. For the circuit shown, current through battery at an instant is 3 A, then at that instant



- (1) Potential across capacitor is 3 V
- (2) Potential across capacitor is 4 V
- (3) Current through capacitor at that instant is 1 A
- (4) Current through capacitor at that instant is 2 A
- 7. Current (*I*) through AC circuit varies with time t as $I = \frac{I_0 t^2}{T^2}$, where I_0 is the peak value of current and T is time duration of the cycle. For the interval $0 \le t \le T$, choose the correct option(s).
 - (1) Average value of current is $\frac{I_0}{2}$
- (2) Average value of current is $\frac{I_0}{3}$
- (3) RMS value of current is $\frac{I_0}{\sqrt{5}}$

(4) RMS value of current is $\frac{I_0}{\sqrt{3}}$

SECTION-III: PARAGRAPH TYPE

This section contains a paragraph. Based upon this paragraph, 2 multiple choice questions have to be answered. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Paragraph for Q. Nos. 8 & 9

Volume charge density in a cylindrical region of radius R varies with axial distance r as $\rho = \frac{\rho_0 r}{R}$ where ρ_0 is positive constant.

8. Total charge contained in a cylinder of unit length is

(1)
$$2\pi\rho_0 R^2$$

$$(2) \quad \frac{\pi \rho_0 R^2}{3}$$

(3)
$$\frac{3\pi\rho_0 R^2}{2}$$

(4)
$$\frac{2\pi\rho_0 R^2}{3}$$

9. Electric field at a distance 2R from the axis of long cylinder is

(1)
$$\frac{\rho_0 R}{\varepsilon_0}$$

$$(2) \quad \frac{\rho_0 R}{2\epsilon_0}$$

$$(3) \quad \frac{2\rho_0 R}{3\epsilon_0}$$

$$(4) \quad \frac{\rho_0 R}{6\epsilon_0}$$

SECTION-IV: ASSERTION-REASON TYPE

This section contains 1 Assertion-Reason type question, which has 4 choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

10. A: Acceleration of charge particle in non-uniform electric field does not depend on velocity of particle.

R: Electric force acting on the charge particle will be dependent on instantaneous velocity.

(1) Both (A) and (R) are true and (R) is the correct explanation of (A)

(2) Both (A) and (R) are true but (R) is not the correct explanation of (A)

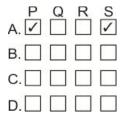
(3) (A) is true but (R) is false

(4) (A) is false but (R) is true

SECTION-V: MATRIX MATCH TYPE

This section contains 1 Matrix Match type question, which has 2 Columns (Column-I and Column-II). Column-I has four entries (A), (B), (C) and (D), Column-II has four entries (P), (Q), (R) and (S). Match the entries in Column-I with the entries in Column-II. Each entry in Column-I may match with one or more entries in Column-II.

For each entry in Column-I, tick the boxes of all the matching entries in Column-II. For example, if entry (A) in Column-I matches with entries (P) & (S) in Column-II, then tick the boxes (P) & (S). Similarly, tick the boxes for entries (B), (C) and (D).



11. For the circuit shown in Column-I, switch S is closed at time t = 0. Column-II gives the value of current through the circuit immediately after closing the switch.

	Column-I		Column-II
(A)	R S L S R	(P)	$\frac{V_0}{4R}$
(B)	$ \begin{array}{c c} 2R & S \\ V_0 & C & + Q \\ \hline & C & - Q \end{array} $ $ Q = \frac{CV_0}{2} $	(Q)	$\frac{V_0}{R}$
(C)	V_0 Z_R C	(R)	$\frac{V_0}{2R}$
(D)		(S)	$\frac{V_0}{3R}$

Space for Rough Work

CHEMISTRY

SECTION-I: SINGLE ANSWER TYPE

This section contains 5 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which

ONLY ONE is correct. 12. Consider a body centered cubic (bcc) arrangement of atoms. Let de, dfd and dbd be the distance between successive atoms located along the edge, the face-diagonal and the body-diagonal respectively in a unit cell. Their order is given by (1) $d_{bd} > d_{fd} > d_e$ (2) $d_{fd} > d_{bd} > d_{e}$ (4) $d_{bd} > d_e > d_{fd}$ (3) $d_{fd} > d_{e} > d_{bd}$ 13. The K_f and K_b values of a solvent (S) are 5.0 K kg mol⁻¹ and 16.0 K kg mol⁻¹ respectively. The boiling point of the solvent is 82.2°C and its freezing point is -2.5°C. What is the boiling point of a solution of a nonvolatile solute (X) in (S) if it freezes at -3.25°C? (1) 84.6°C (2) 86.1°C (3) 87.5°C (4) 88.8°C 14. What are the products formed when N₂O₅ reacts with NaCl? (1) NOCI and NaNO₂ (2) Na₂O and NCl₃ (3) NO₂ and NaClO₃ (4) NO₂Cl and NaNO₃ 15. An aqueous solution of a salt (X) gives green precipitate with KI solution which dissolves in excess of KI along with black residue. The clear colourless filtrate on treatment with Mohr salt in presence of alkali forms brown precipitate. The salt (X) is (2) Calomel (1) Epsom salt (4) Glauber's salt (3) Blue vitriol 16. The rate of a chemical reaction is found to be 0.92 mol L⁻¹ min⁻¹ at 15 min and 0.23 mol L⁻¹min⁻¹ at 45 min from the start of the reaction. What is the order of the reaction if half-life of the reaction is 15 min? (1) Zero order (2) Half order (3) One and a half order (4) First order

SECTION-II: MORE THAN ONE ANSWER TYPE

This section contains 2 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which **MORE THAN ONE** answer may be correct.

- 17. Which of the following statement(s) is/are true about AgI sol prepared by peptization of AgI with AgNO₃?
 - (1) In electrophoresis, the dispersed phase will move towards cathode
 - (2) AlCl₃ is more effective than Na₃PO₄ for bringing about coagulation of sol
 - (3) Charge of diffused layer is -ve in this case
 - (4) Na₃PO₄ is more effective than CaCl₂ for bringing about coagulation of sol
- 18. Identify the compounds/complexes which are expected to be coloured.

(1) CdS

(2) $K_3[Cu(CN)_4]$

(3) $[Cr(NH_3)_6]Cl_3$

(4) $Fe_4 [Fe(CN)_6]_3$

SECTION-III: PARAGRAPH TYPE

This section contains a paragraph. Based upon this paragraph, 2 multiple choice questions have to be answered. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Paragraph for Q. Nos. 19 & 20

An aqueous solution of a compound (A) when treated with H₂S in presence of NH₄OH gives a black coloured compound (B) which is not soluble in dil HCl. (B) on treatment with aqua regia gives back (A). Addition of KCN to (A) gives brown ppt. which dissolves in excess of the reagent to give a compound (C) which changes to (D) when its aqueous solution is boiled. The solution of (A) is treated with NaHCO₃ and then with bromine water when a green coloured compound (E) is formed.

19. Compounds (B) and (C) are respectively

(1) NiS, K₂[Ni(CN)₄]

(2) CoS, K₄[Co(CN)₆]

(3) Cu₂S, Cu₂[Fe(CN)₆]

(4) PbS, Pb(CN)₂

20. Compound (E) is

(1) Ni(HCO₃)₂

(2) CuCO₃

(3) $Na_3[Co(CO_3)_3]$

(4) PbO₂

SECTION-IV: ASSERTION & REASON TYPE

This section contains 1 Assertion-Reason type question, which has 4 choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

- 21. A: The rate of reaction normally increases by a factor of 2 or 3 for every 10°C rise in temperature.
 - R: Increase in temperature increases the number of collisions.
 - (1) Both (A) and (R) are true and (R) is the correct explanation of (A)
 - (2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
 - (3) (A) is true but (R) is false
 - (4) (A) is false but (R) is true

SECTION-V: MATRIX MATCH TYPE

This section contains 1 Matrix Match type question, which has 2 Columns (Column-I and Column-II). Column-I has four entries (A), (B), (C) and (D), Column-II has four entries (P), (Q), (R) and (S). Match the entries in Column-I with the entries in Column-II. Each entry in Column-I may match with one or more entries in Column-II.

For each entry in Column-I, tick the boxes of all the matching entries in Column-II. For example, if entry (A) in Column-I matches with entries (P) & (S) in Column-II, then tick the boxes (P) & (S). Similarly, tick the boxes for entries (B), (C) and (D).

A. 💽	2 Q	R	S ✓
в. [
C.[
D. [

22. Match the complexes given in Column-I with the type of isomerism shown by them in Column-II.

	Column-I		Column-II
(A)	$[Pd(NH_3)_2(SCN)_2]$	(P)	Ionisation isomerism
(B)	[Co(en) ₂ Cl ₂]Br	(Q)	Linkage isomerism
(C)	[Cr(Py) ₂ (NH ₃) ₂ (NO ₂) ₂]Cl	(R)	Geometrical isomerism
(D)	[Zn(gly) ₂]	(S)	Optical isomerism

MATHEMATICS

SECTION-I: SINGLE ANSWER TYPE

This section contains 6 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

23. Let $\int \frac{\sec^2 x}{\csc^2 x} dx = f(x)$, where f(0) = 0 then $f(\pi)$ equals

(1) 0

(2) π

(3) $-\pi$

(4) 2π

24. The minimum value of $f(x) = \sin^{-1} \sqrt{x^2 + x + 1}$ is

(1) $\frac{\pi}{6}$

(2) $-\frac{\pi}{6}$

(3) $\frac{\pi}{3}$

(4) $-\frac{\pi}{3}$

25. Let $f(x) = \begin{cases} \frac{2 - \sqrt{3}\cos x - \sin x}{(6x - \pi)^2} &, x \neq \frac{\pi}{6} \\ \lambda &, x = \frac{\pi}{6} \end{cases}$. The value of λ for which f(x) is continuous at $x = \frac{\pi}{6}$ is

(1) $\frac{1}{9}$

(2) $\frac{1}{18}$

(3) $\frac{1}{27}$

(4) $\frac{1}{36}$

26. If $x^4 y^7 = (x + y)^{11}$ then $\frac{dy}{dx}$ equals

(1) x

(2) *y*

(3) $\frac{y}{x}$

 $(4) \quad \frac{x}{y}$

27. Let $f: R - \{0\} \rightarrow R$ be defined as $f(x) = \log |x|$. Then f(x) is

(1) One-one and onto

(2) One-one and into

(3) Many-one and onto

(4) Many-one and into

28. If $A = \begin{bmatrix} \alpha & 3 \\ 1 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 7 & 3 \\ 1 & 4 \end{bmatrix}$, then the value of α for which $A^2 = B$ is

(1) 1

(2) 2

(3) 3

(4) 4

SECTION-II: MORE THAN ONE ANSWER TYPE

This section contains 3 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which **MORE THAN ONE** answer may be correct.

29. Let the area bounded by the curve $y = x^3 - x$ and x-axis is A_1 sq. units in IV quadrant and A_2 sq. units in II quadrant then

(1)
$$A_1 = A_2$$

(2)
$$A_1 > A_2$$

(3)
$$A_1 < A_2$$

(4)
$$A_1 + A_2 = \frac{1}{2}$$

30. Let $f(x) = \begin{cases} 1 + \ln x &, x > 1 \\ 2x - x^2 &, x \le 1 \end{cases}$. Which of the following is/are FALSE about f(x)?

(1) f(x) is increasing for $x \in R$

(2) f(x) is decreasing for $x \in R$

(3) f(x) increases if x < 1

(4) f(x) decreases if x > 1

31. Let $f(x) = \sin^{-1} x + \cos^{-1} 2x + \tan^{-1} 3x + \sec^{-1} 2x$. Which of the following is/are true about f(x)?

(1) Number of integers in domain of f(x) is zero

(2) Number of integers in domain of f(x) is 1

(3) Range of f(x) is a pair set

(4) Range of f(x) is a singleton set

SECTION-III: PARAGRAPH TYPE

This section contains a paragraph. Based upon this paragraph, 2 multiple choice questions have to be answered. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Paragraph for Q. Nos. 32 & 33

Let f(x) be a polynomial function of degree 6, which satisfies $\lim_{x\to 0} \left(1 + \frac{f(x)}{x^3}\right)^{1/x} = e^2$ and the local maximum at x = 1 and local minimum at x = 0 and x = 2.

32. The coefficient of x^6 in f(x) is

(1) 0

(2) 2

(3) $\frac{-12}{5}$

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

33. The coefficient of x^3 in f(x) is

(1) 0

(2) 2

(3) $\frac{-12}{5}$

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

SECTION-IV: ASSERTION-REASON TYPE

This section contains 1 Assertion-Reason type question, which has 4 choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

34. **A**: The value of $\sin^{-1}\left(\sin\frac{2\pi}{3}\right)$ is $\frac{2\pi}{3}$.

R: The value of $\sin\left(\sin^{-1}\frac{1}{2}\right)$ is $\frac{1}{2}$.

(1) Both (A) and (R) are true and (R) is the correct explanation of (A)

(2) Both (A) and (R) are true but (R) is not the correct explanation of (A)

(3) (A) is true but (R) is false

(4) (A) is false but (R) is true

SECTION-V: MATRIX MATCH TYPE

This section contains 1 Matrix Match type question, which has 2 Columns (Column-I and Column-II). Column-I has four entries (A), (B), (C) and (D), Column-II has four entries (P), (Q), (R) and (S). Match the entries in Column-II with the entries in Column-II. Each entry in Column-I may match with one or more entries in Column-II.

For each entry in Column-I, tick the boxes of all the matching entries in Column-II. For example, if entry (A) in Column-I matches with entries (P) & (S) in Column-II, then tick the boxes (P) & (S). Similarly, tick the boxes for entries (B), (C) and (D).

A. ✓	Q	R	S ✓
В. 🗌			
C. 🗌			
D. 🗌			

35. Let matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$. Then match the entries of Column-I with appropriate entries of Column-II.

	Column-I		Column-II
(A)	det(A) equals	(P)	-2
(B)	The element(s) of principal diagonal of adj(A) is/are	(Q)	-1
(C)	The element(s) of 1 st column of A ⁻¹ is/are	(R)	1
(D)	Cofactor of 2 nd row and 2 nd column element of A is	(S)	2

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Our Result in Olympiads / Scholarship Exams

1598
1556 Classroom + 42 Distance & Digital
in PRMO 2019
450
4.50 385 Classroom + 65 Distance & Digital

115
111 Classroom + 4 Distance & Digital
in RMO 2019
767
701 Classroom + 66 Distance & Digital
in NSEs 2019

949
832 Classroom + 117 Distance & Digital
in NTSE (Stage - I) 2019-20
481
ACC Classes - 15 Distance 0 Distant

in IMO (Level-I) 2018-19

317 Classroom + 49 Distance & Digital
in NTSE (Stage-II) 2019
800
720 Claseroom + 72 Dictance 9 Digital



728 Classroom + 72 Distance & Digital

in NSO (Level-1) 2019-20

in INO 2020













Registered Office / DLP Division: Aakash Tower, 8, Pusa Road, New Delhi-110005. **Ph.:** (011) 47623456 | **E-mail:** reach.us@aesl.in

