COMPETITIVE POTENTIAL ASSESSMENT (CPA) TEST

For Admission to
Three-Years Integrated Excel JEE Program
(X moving students)

1. PREAMBLE :

- In Engineering Education at IITs, NITs or the top Institutions, the Mantra of success is the ability to think on given situation and apply knowledge to find best possible solution in least possible time.
- Potential to succeed in Engineering Entrance Examinations to these institutions is therefore to assess this ability.
- ICAD's CPA test is precisely aimed at this objective, and it consists of carefully framed Multiple Choice Objective Questions.
- 'Mugged up information', casual approach, poor comprehension etc. will not produce any result.

2. DETAILS SYLLABUS:

The syllabus is the contents, students have learned in Physics, Chemistry, and Mathematics up to IX standard (state board / CBSE), Details of the topics are given in the following table. However the question asked in CPA Test will be of probing nature. They will be based on application of the knowledge.

	Syllabus of Physics
1.	**Motion** : types, speed, velocity & acceleration. Graphical representation.
2.	**Uniform Circular Motion** : linear velocity.
3.	**Force & Pressure** : Definition of force, types & actions. Pressure-definition & formula, atmospheric pressure. Application –pumps.
4.	**Force & Motion** : concept of inertia. Newton's laws of motion. Principle of conservation of momentum.
5.	**Gravitation** : Mass & weight. Thrust & pressure. Universal Law of Gravitation. Earth's gravity & value of 'g'.
6.	**Floating bodies** : Pressure in fluids- pressure exerted by gas & liquid pressure. Buoyancy-relative density & Archimedes' Principle.
7.	**Friction** : concept & types. Factors affecting friction. Applications.
8.	**Work, Energy & Power** : Concept & types. Law of conservation of energy.
9.	**Stars & Solar System** : Properties, Application- Satellite motion
10.	**Reflection of light** : Laws of reflection. Simple instruments based on reflection. Sun light, functioning of human eye.
11.	**Sources of Energy** : Solar cell, atomic energy, fossil fuels.
12.	**Combustion & flame** : Concept & types. Structure of flame, properties of fuel. Global warming, Acid rain.
13.	**Magnetism** : Properties & uses of Magnet.
14.	**Some natural phenomena** : Lightning-causes & safety measures, charging by rubbing, types of charge & their interactions. Transfer of charge.
15.	**Electrical circuits** : Electrical conductors & insulators.
16.	**Chemical effects of electric current** : Functions of electro-chemical cell, simple cell, volta cell, dry cell, Ni-Cd cell, button cell. Electroplating.
17.	**Magnetic field of electric current** : Electro-magnetic induction, applications-electromagnet, electrical door bell.

18.	**Sound** : Concept, Sources, Properties, Noise & Music. Production & Propogation. Wave theory & characteristics of sound waves. Speed of sound. Audible sound & ultrasound waves. Reflection, echo & reverberation. Application – SONAR. Human ear.

	Syllabus of Chemistry
1.	**Structure of Atom** : Daltons atomic theory, Thomson's atomic theory, Rutherford's atomic theory, Proton, Neutron & Electron. Atomic number & Mass number. Isotopes. Formation of ions. Valancy. Isobars.
2.	**States & properties of matter** : Change of state.
3.	**Elements compounds & mixtures** : Types of mixtures-(solutions, suspensions & colloidal solutions)
4.	Ions & radicals
5.	**Chemical Reactions** : Concept & types.
6.	**Metals & Non-metals** : Physical & Chemical properties. Uses of metals & non-metals. Nobel metals. Alloys.
7.	**Carbon & Carbon Compounds** : Properties of carbon, allotropes of carbon. Physical, chemical properties & uses of Carbon dioxide, methane etc.
8.	**Air** : components, composition, preparation, properties & uses. Air pollution.
9.	**Properties of substance** : mixtures & methods of separation.
10.	**Synthetic fibers & plastics** : Types & characteristics of fibers and plastics.
11.	**Coal & Petroleum** : Constituents and uses.

	Syllabus of Mathematics
1.	**Number System** : Divisibility. Decimal system-general and expanded form. Operations on & properties of rational numbers. Irrational & Real numbers. Number Line. Operations on & properties of irrational/real numbers.
2.	**Sets** : definition, representation, Venn diagrams. Types & characteristics of sets. Operations on sets. Complement of set, De Morgan's laws.
3.	**Square & square root** : Cube & Cube root.
4.	**Surds** : forms & order of surds. Conjugate of a surd. Operation on surds. Rationalization of surds.
5.	**Indices** : meaning & laws.
6.	**Identities** : expressions & expansions & Identities & factors.
7.	**Simultaneous linear Equations of two variables** : Method of substitution.
8.	**Quadratic equations** : factor method.
9.	**Polynomial of one variable** : Polynomial division & factorization. Synthetic division. Zeros of polynomial. Remainder theorem.
10.	**Commercial Maths** : Compound interest, profit & loss.
11.	**Statistics & data handling** : collection & presentation of date. Frequency distribution, frequency polygon. Histogram. Bar graphs & Pi chart. Measure of central tendency- mean, mode, median. Concept of probability. Applications to coin, die and other simple problems.
12.	**Geometrical figures** : Polygons, concept of symmetry.
13.	**Triangle** : construction, area, congruency & similarity. Triangle inequalities.
14.	**Quadrilaterals** : construction & area of quadrilateral & polygon. Types & properties of quadrilateral.
15.	**Circle** : construction & properties of tangent & arc. Area. Chords & their properties. Cyclic quadrilateral & its properties.
16.	**Parallel lines** : properties & application for segment division.
17.	**Mensuration** : area & volume of geometrical objects cuboid, cube, right circular cylinder, right circular cone, sphere.
18.	**Direct & inverse proportion** : Properties of ratio. Equality & order relation between ratios. Continued ratios.
19.	**Euclid's Geometry** : Postulates. Definition & properties Straight lines, angles, parallel lines, triangles & quadrilaterals.
20.	**Cartesian coordinate system** : Quadrants, coordinates of point in a plane. Sign convention. Distance and section formulae.

21.	**Graph of Linear equation in two variables** : Equation of line.
22.	**Trigonometry** : Trigonometric ratios-definition, values for standard angles, for complementary angles.

3. REFERENCE BOOKS:

- Standard Text Books of Science (Physics & Chemistry) and Mathematics of classes VIII, IX (State Board and NCERT)
- NTSE Books.
- Olympiad Books.
- Any other book for competitive examination for standard VIII/IX.

4. GENERAL INSTRUCTIONS REGARDING TEST PAPER :

- The question paper will consist of objective type questions having multiple choices known as MCQ.
- Each question will have four choices as possible answers, namely (a), (b), (c), and (d).
- There will be negative marking (3R-1W),which means that for correct answer, 3 marks will be awarded and for wrong answer, 1 mark will be deducted.
- All the answers are to be marked by darkening the appropriate bubble(s) against the corresponding question.
- Darkening must be done carefully and fully by BLACK BALL POINT PEN ONLY.
- There is no provision of canceling the darkened bubble and marking another bubble, such answers will be treated as WRONG answers.
- Sample question paper and corresponding correct bubble sheet is provided for your reference.

5. SPECIAL TIPS FOR MAXIMIZING SCORE :

- Give exactly ONE hour to each subject i.e Physics, Chemistry, and Mathematics.
- Start solving question paper sequentially.
- Read the question very carefully, comprehend it while reading, and jot down important things contained in the question on rough sheet/space (1 minute), think whether you can answer it or not (30 sec), if you can answer it, solve and darken the appropriate bubble(s), only if you are confident about the answer (30 sec).
- If you think that it is beyond your limit to get answer, go to the next question; do not waste your time.
- Try to solve as many questions as you can, but darken only those bubbles for which you are confident about the answer.
- Accuracy should be the first criteria than Speed.

6. SAMPLE QUESTION PAPER :

- **The format (No. of Questions, Max. Marks & Time) of the actual CPA test paper may be different than the Sample Paper. However, general nature will remain same.**

ICAD
School of learning
Creating & Nurturing Talent

SAMPLE TEST FOR 150 MINUTES

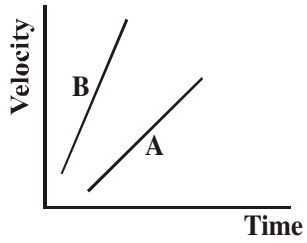
[PHYSICS]

CHOOSE THE CORRECT OPTION :

01. A train covers 80 km in 2 hours and next 50 km in 3 hours. The average speed of the train is
(a) 16 km/hr **(b)** 26 km/hr **(c)** 28.83 km/hr **(d)** 30 km/hr

02. Figure shows the velocity-time graphs for two objects, A and B, moving along the same direction.

Which object has greater acceleration ?



(a) A **(b)** B
(c) both have same acceleration **(d)** None of these

03. Consider a heavenly body which has a mass twice that of the earth and a radius thrice that of the earth. What will be the weight of a book on the this heavenly body, if its weight on the earth is 900 N ?
(a) 400 N **(b)** 200 N **(c)** 900 N **(d)** 600 N

04. A body is dropped from some height. It moves through a distance of 24.5m in the last second before hitting the ground. Find the height from which it was dropped. (Take g = 9.8 m/sec^2)
(a) 11.05 m **(b)** 44.1 m **(c)** 88.2 m **(d)** 22.4 m

05. A coin is placed near the edge of a table and is flicked horizontally. It leaves the table with a horizontal velocity of 25 cm/s. The height of the table is 1.225m. Find the time taken by the coin to reach the floor. (Take g = 9.8 m/sec^2)
(a) 0.5 sec **(b)** 1.0 sec **(c)** 2 sec **(d)**None of these

06. A wave passes over a fixed point in space. Ten troughs and ten crests pass this point in 1 second. Find the frequency of the wave.
(a) 40 Hz **(b)** 20 Hz **(c)** 10 Hz **(d)** 5 Hz

07. At what distance from a concave mirror of focal length 2.5m should a boy stand so that his image is half of his height
(a) 7.5 m to the left of mirror **(b)** 15 m to the left of mirror
(c) 3.5 m to the left of mirror **(d)** 4.5 m to the left of mirror

08. A bomb of mass 9 kg initially at rest explodes into two pieces of masses 3 kg and 6 kg. The Kinetic energy of the 3 kg mass is 216 J. The Kinetic energy of the 6 kg mass is
(a) 432 J **(b)** 216 J **(c)** 108 J **(d)** 54 J

09. A particle moves in a circle of radius R with a constant speed under a centripetal force F. The magnitude of work done in completing a full circle will be
(a) 2 RF **(b)** $\pi R^2 F$ **(c)** $2\pi RF$ **(d)** Zero

10. A car having power 22380 watt is moving with a uniform velocity of 15 m/s. Find the forward force exerted by its engine.
(a) 4192 N **(b)** 1492 N **(c)** 2892 N **(d)** 5692 N

11. An electric pump is used to lift water to a height of 30m. If the power of the pump is 4.9 kW, find the mass of water raised in 2 minutes. ($g = 9.8\ m/s^2$)

(a) 2000 kg **(b)** 4000 kg **(c)** 6000 kg **(d)** 8000 kg

12. Copper sphere of mass 400g is heated to 100°C and then introduced into a copper calorimeter containing 100g of water at 20°C. Find the maximum temperature of the mixture if the mass of calorimeter is 200g and specific heat capacity of copper is 0.1 cal/g° C.

(a) 30°C **(b)** 40°C **(c)** 20°C **(d)** 60°C

13. A certain mass of water at 50°C is poured into an equal mass of water at 20°C. What will be the resulting temperature of the mixture ?

(a) 35°C **(b)** 70°C **(c)** 50°C **(d)** 45°C

14. A force acts on two bodies separately causes acceleration of 3 m/s^2 and 6 m/s^2. If we apply the same force on combination then acceleration of combination will be

(a) 2 m/s^2 **(b)** 9 m/s^2 **(c)** 3 m/s^2 **(d)** $\sqrt{18}\ m/s^2$

15. The temperature of human body is 40°C. Then what is his body temperature in Faranite.

(a) –40°F **(b)** 104 F **(c)** 72°F **(d)** None of these

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[CHEMISTRY]

CHOOSE THE CORRECT OPTION :

16. One micro coulomb is equivalent to :

(a) 6.25×10^{12} electrons **(b)** 6.25×10^{-12} electrons

(c) 6.25×10^{-18} electrons **(d)** 6.25×10^{19} electrons

17. Which of the following would contain the same numbers of atoms as 12 g. of magnesium? (At wts.: Mg = 24; C = 12; Ca = 40):

(a) 12 g. of carbon **(b)** 20 g. of calcium **(c)** 32 g. of oxygen **(d)** 40 g. of potassium

18. Cathode rays :

(a) are the currents of electrons **(b)** are the currents of protons

(c) are the rays of light **(d)** can be seen by the eyes

19. The IUPAC name of tertiary butyl chloride

(a) 2-chloro-2,2-dimethyl propane **(b)** 1-chloro-2-methyl propane

(c) 2-chloro-2-methyl propane **(d)** 2-chloro-2-ethyl propane

20. When a lead storage battery is charged, then :

(a) PbO_2 dissolves

(b) The lead electrode becomes coated with lead sulphate

(c) Sulphuric acid is regenerated **(d)** The amount of acid decreases

21. Chlorapalite is

(a) $Ca_3(PO_4)_2$ **(b)** CaF_2 **(c)** $3Ca_3(PO_4)_2 \cdot CaCl_2$ **(d)** $23Ca_3(PO_4)_2 \cdot CaF_2$

22. Chloral has formula

(a) CCl_3COOH **(b)** CCl_3COCl **(c)** CH_3CHO **(d)** $CCl_3–CHO$

23. The composition of German silver is

(a) 40% Cu + 30% Zn + 30% Ni **(b)** 60% Cu + 20% Zn + 20% Ni

(c) 25% Cu + 25% Zn + 50% Ni **(d)** 50% Cu + 25% Zn + 25% Ni

24. The most important element present in stainless steel is

(a) iron **(b)** carbon **(c)** chromium **(d)** Nickel

25. Aromatic hydrocarbons have

(a) open chain **(b)** closed chain **(c)** branch chain **(d)** cross chain

26. Water is a / an

(a) ionic compound **(b)** covalent compound

(c) co-ordinate covalent compound **(d)** polar covalent compound

27. The beam of red light and green light fall on the same spot on a white screen. The colour on the screen will be

(a) Blue **(b)** Cyan **(c)** Yellow **(d)** Black

28. One mega joule approximately equals

(a) 240 kcal **(b)** 2400 kcal **(c)** 24 kcal **(d)** 2.4 kcal

29. The cataion which have largest size

(a) Li^+ **(b)** Na^+ **(c)** Cs^+ **(d)** K^+

30. Select the correct statement :

In the gas equation $PV = nRT$

(a) n is the number of molecules of a gas **(b)** n moles of the gas have volume V

(c) V denotes voluem of one mole

(d) P is the pressure of the gas when only one mole of gas is present

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[MATHEMATICS]

CHOOSE THE CORRECT OPTION :

31. The lengths of the three sides of a triangle are respectively 12 cm, 10 cm and 8 cm. The length of the median drawn from the vertex opposite the greatest side will be

(a) $\sqrt{48}$ cm **(b)** $\sqrt{50}$ cm **(c)** $\sqrt{30}$ cm **(d)** $\sqrt{46}$ cm

32. The figure below shows concentric squares. The perimeter of the innermost square is 16 cm. The dotted line indicates an indefinite number of squares. The perimeter of the n^{th} square (counting the innermost as the first) is 8 cm more than the perimeter of the $(n-1)^{th}$ square for all $n > 1$. The area between the 9^{th} and the 10^{th} squares (in sq. cms) is,

(a) 76 **(b)** 80 **(c)** 84 **(d)** 92

33. There are some sweets with me. If I distribute them equally among 10, 16 or 20 childeren, I would be left with 1 sweet in each case. If I distribute the sweets equally among 23 children, I would not have any sweets left with me. How many sweets do I have ?

(a) 92 **(b)** 115 **(c)** 150 **(d)** 161

34. After travelling for 30 minutes a train meets an accident, due to which it has to stop for 45 minutes. Due to the accident its speed is also reduced to 2/3 of its former value and the train reaches its destination 1 hour 30 minutes late. Had the accident occurred 60 km later, the train would have reached 30 minutes earlier. The length of journey is

(a) 90 km **(b)** 120 km **(c)** 150 km **(d)** 180 km

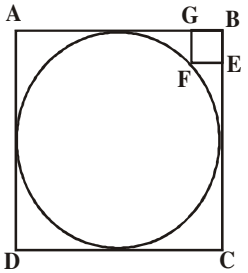
35. Out of 100 students, 50 fail in English and 30 in Mathematics. If 12 student fail in both English and Mathematics, the number of students passing both these subjects is

(a) 8 **(b)** 20 **(c)** 32 **(d)** 50

36. If $\alpha + \beta = 90°$ and $\alpha = 2\beta$, then $\cos^2\alpha + \sin^2\beta$ equals to

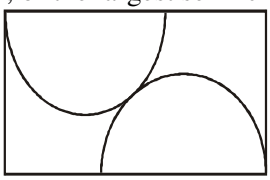
(a) 1/2 **(b)** 0 **(c)** 1 **(d)** 2

37. A circle touches the four sides of square ABCD. BEFG is a square of side 1. The length of AB is



(a) $4 + 2\sqrt{2}$ **(b)** 2π **(c)** $5\sqrt{2}$ **(d)** $\frac{5}{2}\pi$

38. A taylor wants to cut two semi-circles as shown, with the same diameter from a cloth measuring 80 cm by 160 cm. The diameters, in cm, of the largest semi-circles are



(a) 120 **(b)** 90 **(c)** 80 **(d)** 100

39. Find $\sqrt{2-\sqrt{3}}$

(a) $\sqrt{3}+2$ **(b)** $\frac{\sqrt{3}-1}{\sqrt{2}}$ **(c)** $\sqrt{6}-\sqrt{2}$ **(d)** does not exit

40. Three equal glasses are filled with a mixture of alcohol and water. The proportion of alcohol to water in each glass is as follows :

in the first glass as 2 : 3,

in the second glass as 3 : 4

in the third glass as 4 : 5

The contents of the three glasses are emptied into a single vessel. What is the proportion of alcohol and water in it.

(a) $\frac{133}{60}$ **(b)** $103:60$ **(c)** $401:544$ **(d)** $\frac{401}{315}$

41. The quadratic polynomial is divisible by $x-2$ and $x+3$. When it is divided by $x-1$, the remainder is -8. Therefore the polynomial is .....

(a) x^2+x-6 **(b)** $2(x^2+x-6)$ **(c)** $2x^2+x-6$ **(d)** x^2+2x-8

42. Find the 4th proportional of $\sqrt{2},\sqrt[3]{2},\sqrt[4]{2}$

(a) $\sqrt[6]{2}$ **(b)** $\sqrt[8]{2}$ **(c)** $\sqrt[10]{2}$ **(d)** $\sqrt[12]{2}$

43. For the following data : $1,1,0,2,3,5,5,6,8,10,11$

(a) Mean = mode = median **(b)** Mean = mode

(c) Mode = median **(d)** mean = 5

44. The number of triangles formed with any of three of length 1, 2, 3, 4 cms as its sides is

(a) 4 **(b)** 1 **(c)** 3 **(d)** 0

45. If $\frac{a}{3}=\frac{b}{4}=\frac{c}{7}$ then $\frac{a+b+c}{abc}$ is equal to

(a) $\frac{7}{2}b^2$ **(b)** $2b^2$ **(c)** $\frac{8}{3}b^2$ **(d)** $\frac{8}{3b^2}$

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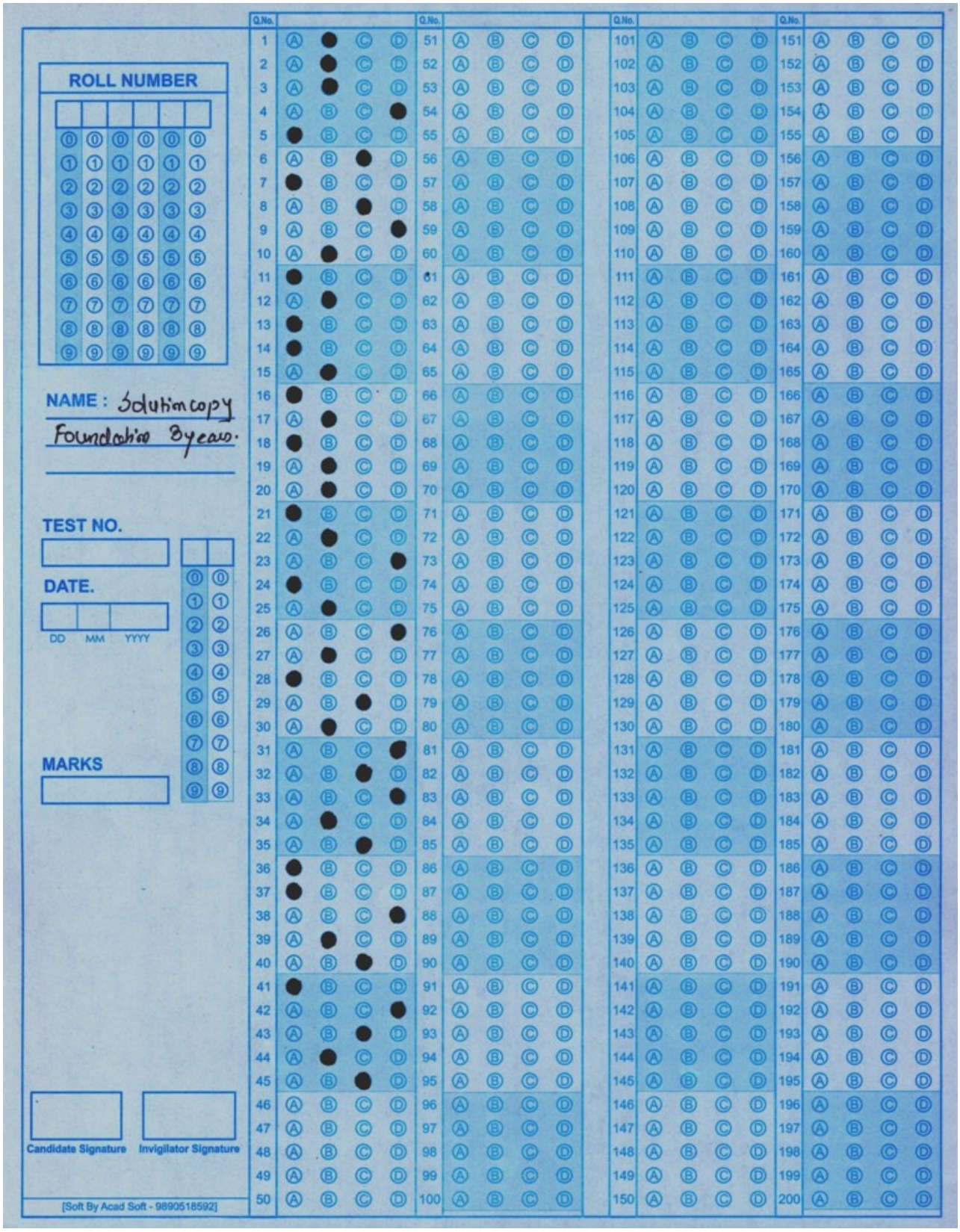
Answer Key :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