N G S F

NGSE

CLASS 11 Time : 90 Minutes **National Genius Search Examination® : Advanced**

Your NGSE Roll No ☐☐☐☐☐☐☐ Date of the Test_____

Student's Name ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Signature of the Student	Signature of the Invigilator Check the correctness of the Roll No. with hall ticket.

INSTRUCTIONS TO THE CANDIDATE

1. **DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO.**
2. Fill and sign the Question cum Answer Booklet. Fill the information required in the answer sheet.
3. Do not seek clarification on any item in the test booklet from anyone including the test invigilator or the centre supervisor. Use your best judgement.
4. This booklet consists of two sections as given below :

No.	Subject	Question Nos	No.	Subject	Question Nos
1.	Mathematics	1-5	5.	Economics	21-25
2.	Physics	6-10	6.	Accountancy	26-30
3.	Chemistry	11-15	7.	Business Studies	31-35
4.	Biology	16-20			

Choose the same subjects that you have opted for NGSE-Mains and answer those two subjects only

5. Use black/blue ball point pen only for writing the answers.
6. Use of mathematical instruments /compass box is allowed. Calculators are not allowed but logarithmic tables are allowed.
7. All questions are compulsory. Each question carries 10 marks. Negative marks are not awarded.
8. Candidate should write the question numbers against each answer. No additional sheet will be supplied. No loose sheet should be attached to this Booklet. Return this booklet to the invigilator after the test.
9. Failure to follow instructions and examination norms will lead to disqualification.

PLEASE WAIT FOR THE SIGNAL TO OPEN THE TEST BOOKLET

Open from this side ⟶

SECTION – 1: MATHEMATICS

1. Circles are drawn through the point (c, 0) touching the circle $c^2 + y^2 = a^2$. P is a point such that the tangents at the extremities of any chord passing through P intersect on the x-axis. Show that the locus of P is
$4a^2(x - c)^4 = (a^2 - c^2)[a^2 - (c - 2x)^2]y^2$

2. (i) How many triangles oriented the same way as ABC can be seen in a grid like the one shown in figure? The grid consist of n rows.
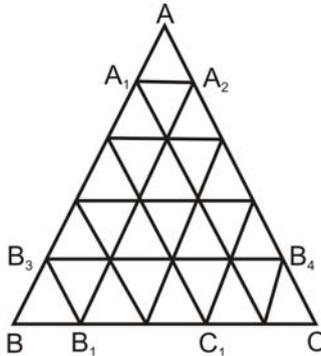
(ii) Express the number of triangles which can be seen the other way up as a sum of binomial coefficients. Also obtain the value of that sum.

3. Prove the identity
$$\frac{1}{^{2n+1}C_r} + \frac{1}{^{2n+1}C_{r+1}} = \frac{2n+2}{2n+1} \cdot \frac{1}{^{2n}C_r}$$
$$\sum_{r=1}^{2n-1} \frac{(-1)^{r-1} \cdot r}{^{2n}C_r} = \frac{n}{n+1}$$

4. (i) Out of m persons sitting at a round table, the persons, A, B and C are selected at random. Prove that the chance that no two of these are sitting together is $(m - 4)(m - 5)/(m - 1)(m - 2)$
(ii) If n distinct biscuits are distributed among N beggars. This is true for chance that a particular beggar will get exactly $r(< n)$ biscuits.

5. (i) If $\frac{ax}{\cos\theta} + \frac{by}{\sin\theta} = a^2 - b^2$ and $\frac{ax\sin\theta}{\cos^2\theta} - \frac{by\cos\theta}{\sin^2\theta} = 0$, show that $(ax)^{2/3} + (by)^{2/3} = (a^2 - b^2)^{2/3}$.
(ii) If $\frac{\cos^3\theta}{\cos(\alpha-3\theta)} = \frac{\sin^3\theta}{\sin(\alpha-3\theta)} = k$, then show that $2k^2 - k\cos\alpha - 1 = 0$.

SECTION – 2: PHYSICS

6. (a) A rocket consumes 250 gm of fuel per second and ejects the gas with a speed of 8 km/s. Calculate the thrust exerted on the rocket by the ejected gas?

(b) The mass of a pendulum bob is 100 gm and the string is one meter long. the bob is held so that the string is horizontal and it is then allowed to fall. Find the K. E. when the string makes an angle of (i) 0^0 and (ii) 30^0 with the vertical.

7. (a) A block of mass 10 kg is dragged across a horizontal surface by pulling the block with force of 100 N. The force is applied by attaching a chord to the block. The chord is inclined at an angle of 60^0 with the horizontal. If the coefficient of kinetic friction is 0.2 what is the acceleration of the block?

   (b) An engine pumps water from a tank at the rate of 10 kg per second and ejects from a nozzle 7 m above the surface of the tank with a velocity of 20 m/s. What is the output power of the engine?

8. (a) A stone of mass 0.3 kg tied to the end of a string in a horizontal plane is whirled round in a circle of radius 1 m with a speed of 40 rev/min. What is the tension in the string? What is the maximum, speed with which the stone can be whirled around if the string can withstand a maximum tension of 200 N?

   (b) A circular disc of 49 kg and radius 50 cm is rotating at a speed of 120 rotations per minute. Calculate its kinetic energy if is moment of inertia about the axis of rotation is $\frac{1}{2}mr^2$.

9. (a) Derive an expression for the moment of inertia of a thin spherical shell about a diameter.

   (b) The escape velocity of a projectile on the earth's surface is $11.2\ km^{-1}$. A body projected out with thrice this speed. What is the speed of the body far away from the earth? Ignore the presence of the sun and other planets.

10. (a) A wire 2 mm in diameter is just stretched in between two fixed points at a temperature of $50^0 C$. Calculate the tension in the wire, when the temperature falls to 30^0 C. Coefficient of linear expansion is $11 \times 10^{-6} \rho C$ and Young's modulus is $2.1 \times 10^{11}\ Nm^2$.

    (b) Water rises in a capillary tube to a height 4 cm. If the tube is inclined at an angle of 45^0 with the vertical, find the position of the water in the tube.

SECTION – 3: CHEMISTRY

11. (a) Water can react with hydrogen ions to make the oxonium ion, H_3O^+. What is present in a water molecule that allows it to react with a hydrogen ion? Describe the bonding in the oxonium ion. Draw a dot-and-cross diagram for the molecule.

    (b) Explain why N_2 has greater bond dissociation energy than N_2^+ whereas O_2 has lesser bond dissociation energy than O_2^+.

12. (a) Calculate the volume occupied by 4.045×10^{23} molecules of oxygen at $27^0 C$ and having a pressure of 0.935 bar.

(b) A spherical balloon of 21 cm diameter is to be filled with hydrogen at N. T. P. from a cylinder containing the gas at 20 atmosphere and $27^0 C$. If the cylinder can hold 2.82 litres of water calculate the number of balloons that can be filled up.

13. (a) Calculate the standard enthalpy of formation of carbon disulphide (l). Given that the standard enthalpies of combustion of carbon (s), sulphur (s) and carbon disulphide (l) are -393.3, -293.72 and -1108.76 kJ mol^{-1} respectively.

(b) How would you explain the following o9bservations?
(a) BeO is almost insoluble but $BeSO_4$ issoluble in water,
(b) BaO is soluble but $BaSO_4$ is insoluble in water,
(c) LiI is more soluble than KI in ethanol.

14. (a) Consider the reaction:
$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) + 189.4 \, kJ$.
Indicate the direction in which the equilibrium will shift when
  (a) temperature is increased
  (b) volume is increased
  (c) a catalyst is added
  (d) pressure is decreased
  (e) concentration of SO_2 is increased
  (f) helium gas is added at constant volume so that the total pressure is increased
  (g) helium gas is added at constant pressure.

(b) 0.16 g of N_2H_4 are dissolved in water and total volume made upto 500 ml. Calculate the percentage of N_2H_4 that has reacted with water in this solution. The K_b for N_2H_4 is 4.0×10^{-16} M.

15. (a) The mass of 525 ml of a gaseous compound at 28^0 C and 0.970 bar pressure was found to be 0.900 g. Calculate the molar mass of the compound.

(b) How much energy is released when 6 moles of octane is burnt in air? Given $\Delta H_f{}^0$ for $CO_2(g), H_2O(g)$ and $C_8H_{18}(g)$ are respectively $-490, -240$ and $+160$ kJ/mol.

SECTION – 4: BIOLOGY

16. (a) Give a comparative account of the classes of Kingdom Fungi under the following:
  (i) mode of nutrition
  (ii) mode of reproduction

(b) Differentiate between the following:
  (i) red algae and brown algae
  (ii) liverworts and moss
  (iii) homosporous and heterosporous pteridophyte
  (iv) syngamy and triple fusion

17. (a) Give the diagnostic features of Arthropoda.
    (b) Write short notes on phyllotaxy and heterophylly.

18. (a) List various functions of plasma of blood.
    (b) Describe polymorphism in lysosomes.

19. (a) Describe the basic structure, types and biological importance of amino acids.
    (b) Enumerate IUB system of classification of enzymes.

20. (a) What role does root pressure play in water movement in plants?
    (b) Describe C_4 cycle in plants for CO_2 fixation. Name atleast two C_4 plants.

SECTION – 5: ECONOMICS

21. Critically analyze the current economic scenario in view of the falling GDP growth in India.

22. Why should the Government spend more on education and health? What are the expected result of such spending?

23. Why energy is the critical component of infrastructure? What is its role in economic growth?

24. What are the current concerns about environment in India? How it affect the economic growth of the country? How carbon credits are connected with the environment?

25. Is the growth in the services sector sustainable? Critically analyze how it is connected with the demographics of the country?

SECTION – 6: ACCOUNTANCY

26. The cash book of Mr. Avinash shows Rs 8.364 as the balance at bank as on 31st Dec, 2011 but you find that this does not agree with the balance as per the Bank Pass Book. On scrutiny, you find the following discrepancies.
    (a) On 15th Dec, the payments side of the Cash Book was undercast by Rs 100.
    (b) A cheque for Rs 131 issued on 25th Dec, was recorded in the Cash column.
    (c) One deposit of Rs 150 was recorded in the Cash Book as if there is not Bank Column therein.
    (d) On 18th Dec, the debit balance of Rs 1,526 as on the previous day, was brought forward as a credit balance.
    (e) Of the total cheques amounting to Rs. 11, 514 drawn in the last week of Dec, cheques aggregating Rs 7,815 were encashed in Dec.
    (f) dividends of Rs 250 collected by the Bank and subscription of Rs 100 paid by it, were not recorded in the Cash Book.
    (g) One out-going cheque of Rs 350 was recorded twice in the Cash Book.
       Prepare a Bank Reconciliation Statement as on 31st Dec. 2011.

27. Pass the necessary entries to rectify the following errors on 31st March, 2012 and also show the effect of rectification on closing stock and profit:
    (a) The proprietor has taken goods costing Rs. 1, 000 for his personal use without making entry in the books.
    (b) The proprietor has given away goods costing Rs. 1, 000 as free samples for which no entry was made in the books of accounts.
    (c) Purchases for the year included a purchase of furniture costing Rs. 200 on 31st March 2012.
    (d) Sales included a sale of furniture having a book value of Rs. 900 for Rs. 850 on 31st March 2012.
    (e) Invoices for goods costing Rs. 1, 700 have been entered on 26th March 2012 but the goods have not yet been received till 31st March 2012.
    (f) Goods costing Rs. 4, 000 have been purchased and received on 27th March 2012 but the invoices have not yet been recorded till 31st March 2012.
    (g) Invoices of goods of Rs. 1, 000 (Cost Rs. 800) were entered on 28th March 2012 but the goods were not delivered will 31st March, 2012.
    (h) Goods of Rs. 4, 000 (Cost Rs. 3, 200) sold and delivered on 29th March 2012 but the invoices were not entered till 31st March, 2012.
    (i) goods (Cost Rs. 2,880, selling price Rs. 3, 600) were returned by Ram, a customer on 30th March and were taken into stock on the same date but no entry was passed in the books.
    (j) Stock at the end does not include the goods (cost Rs. 6, 000, welling price Rs. 7, 500) returned by Shayam a customer for which the entry has already been passed.
    (k) On 26th March, goods of the sale value of Rs. 2, 00, 000 were sent on sale or return basis to Gopal, a customer the period of approval being two weeks. He returned 20% of the goods and approved 80% of the remaining on 31st March. These goods were sent at a profit of 25% on cost.

28. X Ltd. has imported a machine on July 1, 2011 for Rs 1, 28, 000, paid customers duty and freight Rs 64, 000 and incurred erection charges Rs 48, 000. Another local machinery costing Rs 80, 000 was purchased on January 1, 2012. On July, 1 2013 a portion of the imported machinery (value one third) got out of order and was sold for Rs 27, 840. Another machinery was purchased to replace the same for Rs. 40, 000. Depreciation to be calculated at 20% p. a.
    Required: Show the Machinery Account for 2011, 2012 and 2013.

29. A lease is purchased on 1st January, 2011 for 4 years at a cost of Rs 20, 000. It is proposed to depreciate the lease by the annuity method charging interest @ 5% p. a. A reference to the annuity table shows that to depreciate Re 1 by annuity method over 4 years charging interest at 5% p. a. one must write off a sum of Re. 0.2820. Show the Lease Account for four years and also the relevant entries in the Profit and Loss Account.

30. A sold goods to B for Rs 10, 000 on 1 Jan. and drew upon him a three months bill for the amount. B accepted the bill and returned it to A. One month before the due date,

B returned the bill under a rebate 18% p. a. Pass the necessary journal entries in the books of A and B.

SECTION – 7 : BUSINESS STUDIES

31. What are the major forms of business organizations in India? How they function? What are the advantages for each of them?

32. What is the importance of social responsibilities and business ethics in India?

33. How internal trade influence external trade? Critically discuss your points.

34. Explain the steps involved in the formation of a public limited company?

35. What are the main sources of finance for a public limited company? Discuss how the company can utilize such sources list the advantages and disadvantages for each of them.

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