057/2022

Question Booklet Alpha Code	**A**	Question Booklet Serial Number

Total Number of questions : 100   **Time : 90 Minutes**

Maximum Marks : 100

A

INSTRUCTIONS TO CANDIDATES

1. The question paper will be given in the form of a Question Booklet. There will be four versions of question booklets with question booklet Alpha Code viz. A, B, C & D.

2. The Question Booklet Alpha Code will be printed on the top left margin of the facing sheet of the question booklet.

3. The Question Booklet Alpha Code allotted to you will be noted in your seating position in the Examination Hall.

4. If you get a question booklet where the Alpha Code does not match to the allotted Alpha Code in the seating position, please draw the attention of the Invigilator IMMEDIATELY.

5. The Question Booklet Serial Number is printed on the top right margin of the facing sheet. If your question booklet is unnumbered, please get it replaced by new question booklet with same Alpha Code.

6. The question booklet will be sealed at the middle of the right margin. Candidate should not open the question booklet, until the indication is given to start answering.

7. Immediately after the commencement of the examination, the candidate should check that the question booklet supplied to him contains all the 100 questions in serial order. The question booklet does not have unprinted or torn or missing pages and if so, he/she should bring it to the notice of the Invigilator and get it replaced by a complete booklet with same Alpha Code. This is most important.

8. A blank sheet of paper is attached to the question booklet. This may be used for rough work.

9. **Please read carefully all the instructions on the reverse of the Answer Sheet before marking your answers.**

10. Each question is provided with four choices (A), (B), (C) and (D) having one correct answer. Choose the correct answer and darken the bubble corresponding to the question number using Blue or Black Ball Point Pen in the OMR Answer Sheet.

11. **Each correct answer carries 1 mark and for each wrong answer 1/3 mark will be deducted. No negative mark for unattended questions.**

12. No candidate will be allowed to leave the examination hall till the end of the session and without handing over his/her Answer Sheet to the Invigilator. Candidates should ensure that the Invigilator has verified all the entries in the Register Number Coding Sheet and that the Invigilator has affixed his/her signature in the space provided.

13. Strict compliance of instructions is essential. Any malpractice or attempt to commit any kind of malpractice in the Examination will result in the disqualification of the candidate.

1. Convert 0.1N to dynes

   (A) 10000 (B) 1000 (C) 100 (D) 10

2. The unit which is not derived is

   (A) Pascal (B) Joule (C) Candela (D) Watt

3. Which of the following conversion takes place in bourdon tubes?

   (A) Pressure to current (B) Pressure to displacement

   (C) Pressure to strain (D) Pressure to velocity

4. Which of the following is a non-contact type thermometer?

   (A) Thermocouple (B) Bimetal strip thermometer

   (C) Vapour pressure thermometer (D) Optical Pyrometer

5. Which of the following is correct?

   (A) Absolute Pressure = Gauge pressure – atmospheric pressure

   (B) Atmospheric Pressure = Gauge pressure + absolute pressure

   (C) Gauge pressure = Absolute pressure – atmospheric pressure

   (D) Absolute Pressure = Gauge pressure – Suction pressure

6. Which one of the following is not the unit of energy?

   (A) Kilowatt hour (B) Newton meter

   (C) Kilowatt (D) Joule

7. Calorie is a measure of

   (A) Quantity of Heat (B) Specific Heat

   (C) Thermal Capacity (D) Entropy

8. The vacuum pressure is always the negative gauge pressure

   (A) No (B) Yes (C) Can't say (D) None

9. Weight of the body in Newtons (N) is

   (A) $kg\ m/s^3$ (B) $kg\ m/s^2$ (C) $kg\ m^2/s^2$ (D) $kg\ m^2/s$

10. Light Year is a unit of

    (A) Luminous Intensity (B) Time

    (C) Velocity (D) Distance

11. If 0.8 and 0.9 are the dryness fraction obtained in separating calorimeter and throttling calorimeter respectively, then in combined separated and throttling calorimeter the actual dryness fraction of steam is

    (A) 0.85 (B) 0.72 (C) 0.10 (D) 0.42

12. Triple point temperature and pressure for water are
    (A) 4°C and 101.325 kPa
    (B) 0°C and 101.325 kPa
    (C) 0.01°C and 0.6108 kPa
    (D) 0°C and 0.6108 kPa

13. Specific volume of wet steam with dryness fraction x is
    (A) $x\,v_g$
    (B) $x^2 v_g$
    (C) $x v_f$
    (D) $x_2 v_f$

14. Steam coming out of the whistle of pressure cooker is
    (A) Ideal gas
    (B) Superheated steam
    (C) Dry saturated steam
    (D) Wet steam

15. The properties of water and steam become identical at
    (A) 10^4 Pa
    (B) 2.122×10^7 Pa
    (C) 2.122×10^5 Pa
    (D) 10^5 Pa

16. Calculate the dryness fraction of steam which has 1 kg of water in suspension with 49 kg of steam
    (A) 0.98
    (B) 0.02
    (C) 1
    (D) 1.02

17. Specific volume of water when heated at 273.15 K
    (A) First increases and then decreases
    (B) Increases steadily
    (C) First decreases and then increases
    (D) Decreases steadily

18. Heat of superheated steam is given by
    (A) $h_{sup} = h_f + h_{fg} + c_{ps} \log_e (T_{sup} / T_s)$
    (B) $h_{sup} = h_f + h_{fg}$
    (C) $h_{sup} = h_f + x\,h_{fg}$
    (D) $h_f + x\,h_{fg} + c_{ps} \log_e (T_{sup} / 273)$

19. With increase in pressure the enthalpy of dry saturated steam
    (A) Increases
    (B) First decreases then increases
    (C) First increases then decreases
    (D) Decreases

20. Superheating of steam done at constant
    (A) Enthalpy
    (B) Volume
    (C) Temperature
    (D) Pressure

21. Nothing in this the Boilers Act 1923 shall apply to
    (A) in any vessel propelled wholly or in part by the agency of steam
    (B) appertaining to a sterilizer disinfector used in hospitals or nursing homes, if the boiler does not exceed one hundred liters in capacity
    (C) locomotive boilers belonging to or under the control of the railways
    (D) all of the above

22. The economizer can be operated after issue of
    (A) Form IX   (B) Form XI   (C) Form V   (D) Form VI

23. For a boiler having outside diameter below 2 ft. 6 inches, the manhole or sight hole size shall be
    (A) 14 inches × 10 inches   (B) 15 inches × 11 inches
    (C) 9 inches × 7 inches   (D) 12 inches × 9 inches

24. For feed water and boiler water, test methods shall be carried out as prescribed in the appropriate clauses as shown below:
    (A) IS : 3025 - 1964 only   (B) IS : 3025 - 1965 only
    (C) IS : 3025 - 1964 and IS : 3025 - 1965   (D) None of the above

25. The Chief Inspector and all Deputy Chief Inspectors and Inspectors shall be deemed to be public servants within the meaning of _____ of the Indian Penal Code (45 of 1860).
    (A) Section 21   (B) Section 22   (C) Section 23   (D) Section 24

26. Which of the following is an integral part of a boiler, which increases the efficiency of the boiler?
    (A) Mountings   (B) Accessories   (C) Furnace   (D) Grate

27. Which of the following statements is/are correct about a horizontal type boiler?
    (i) It occupies more space
    (ii) It can be inspected easily
    (iii) It can be repaired easily
    (A) Only (i & ii)   (B) Only (ii & iii)   (C) Only (i & iii)   (D) All of the above

28. A high pressure boiler is one which produces steam at a pressure of
    (A) 60-80 bar   (B) 80 bar and above
    (C) 200 bar and above   (D) 40-60 bar

29. Which of the following statements is/are correct about Babcock and Wilcox boiler?
    (i) It is a horizontal fire tube boiler   (ii) It is a horizontal water tube boiler
    (iii) It is a natural circulation type boiler   (iv) It is a forced circulation type boiler
    (A) Only (i & iii)   (B) Only (ii & iii)
    (C) Only (ii & iv)   (D) Only (i & iv)

30. Which of the following statements is/are correct about Stirling boiler?

    (i) It is a water tube boiler

    (ii) It is a bent tube boiler with steam drums and water drum.

    (iii) It is a water tube boiler with straight tubes.

    (iv) It is popular for large central power stations.

    (A) Only (i & iii)　　　(B) Only (i & ii)　　　(C) Only (i, ii & iv)　　　(D) All of the above

31. Match the following statements in Column 1 to that in Column 2

Column 1	Column 2
(a) Horizontal straight tube boiler	(i) Cochran
(b) Vertical multi-tubular boiler	(ii) Stirling
(c) Bent tube boiler	(iii) Babcock and Wilcox
(d) Single tube boiler	(iv) Simple vertical boiler
(A) a-ii, b-i, c-iii, d-iv	(B) a-i, b-ii, c-iv, d-iii
(C) a-iv, b-ii, c-iv, d-iii	(D) a-iii, b-i, c-ii, d-iv

32. Which of the following combinations represents boiler mountings?

    (A) Fusible plug and Economizer

    (B) Blow off cock and super heater

    (C) Safety valves and feed pumps

    (D) Pressure gauges and water level gauges

33. Which of the following is not a horizontal boiler?

    (A) Lancashire　　　　　　　　(B) Locomotive

    (C) Babcock and Wilcox　　　　(D) Cochran

34. Match the following statements in Column 1 to that in Column 2:

Column 1	Column 2
(a) High Pressure boiler	(i) Locomotive
(b) Forced circulation boiler	(ii) Benson
(c) Low pressure boiler	(iii) Lancashire
(d) Portable boiler	(iv) Babcock and Wilcox
(A) a-iv, b-ii, c-iii, d-i	(B) a-i, b-iii, c-ii, d-iv
(C) a-iii, b-iv, c-ii, d-i	(D) a-ii, b-iii, c-iv, d-i

35. For the same power, the shell diameter of fire tube boiler compared to that of water tube boiler is

(A) Smaller   (B) Larger   (C) Equal   (D) None of these

36. Which of the following statements is/are correct about the fire tube boilers?

(i) They are suitable for larger power plants

(ii) They can work under very high pressure as 100 bar

(iii) Requires less skill for efficient and economic working

(iv) Construction and transportation are difficult

(A) Only (i & ii)   (B) Only (ii, iii & iv)   (C) Only (iii & iv)   (D) Only (ii & iii)

37. Match the following boiler terms in Column 1 to that of their description in Column 2:

Column 1	Column 2
(a) Foaming	(i) Blocks of asbestos or magnesia insulation wrapped on the outside of boiler shell
(b) Scale	(ii) Removal of mud and other impurities of water from lowest part of boiler
(c) Blowing off	(iii) Formation of steam bubbles on the surface of boiler water
(d) Lagging	(iv) Deposit of medium to extreme hardness occurring on water heating surface of a boiler

(A) a-iii, b-iv, c-ii, d-i   (B) a-ii, b-i, c-iv, d-iii

(C) a-iii, b-iv, c-i, d-ii   (D) a-ii, b-i, c-iii, d-iv

38. Next to oxygen, the main cause of corrosion in boilers is

(A) Nitrogen   (B) Methane

(C) Carbon dioxide   (D) Hydrogen

39. Which of the following combinations represents mechanical methods of feed water treatment in boilers?

(A) Filtration and Deaeration   (B) Sedimentation and coagulation

(C) Sedimentation and distillation   (D) Coagulation and Deaeration

40. The correct sequence which indicates the effect of scale formation in boiler is

(A) Overheating $\rightarrow$ Rupturing $\rightarrow$ Blistering

(B) Rupturing $\rightarrow$ Blistering $\rightarrow$ Overheating

(C) Overheating $\rightarrow$ Blistering $\rightarrow$ Rupturing

(D) Blistering $\rightarrow$ Overheating $\rightarrow$ Rupturing

41. Which of the following statements is/are correct regarding 'turbidity' in feed water?

    (i) It indicates coarse particles which settle down in stationary water.

    (ii) It is the suspended insoluble matter

    (A) Only (i)   (B) Only (ii)

    (C) Both (i & ii)   (D) None of these

42. The formation of hard surfaces which resists the heat transfer and clogs the passages in pipes of boiler is caused by

    (A) Calcium bicarbonate   (B) Calcium chloride

    (C) Calcium sulphate   (D) All of the above

43. Match the various types of feed water treatment methods in Column 1 to that in Column 2

    Column 1   Column 2

    (a) Mechanical treatment   (i) Lime soda softening

    (b) Thermal treatment   (ii) Coagulation

    (c) Chemical treatment   (iii) Uses a series of cation and anion exchangers

    (d) Demineralisation   (iv) Deaeration

    (A) a-iii, b-i, c-ii, d-iv   (B) a-i, b-ii, c-iii, d-iv

    (C) a-ii, b-iv, c-i, d-iii   (D) a-ii, b-i, c-iv, d-iii

44. Which of the following are the favourable conditions for corrosion in boilers?

    (A) Low pH, Dissolved O_2 & CO_2 (B) High pH Dissolved O_2 & CO_2

    (C) Dissolved O_2 & CO_2, Alkali salts   (D) All of the above

45. Which of the following statements is/are correct about hot process phosphate softening of feed water in boilers?

    (i) It is a thermal method of treatment

    (ii) It uses trisodium phosphate and caustic soda

    (iii) It uses lime and soda ash

    (iv) It is a chemical treatment

    (A) Only (i & ii)   (B) Only (ii & iv)

    (C) Only (i & iii)   (D) Only (iii & iv)

46. The corrosion in boilers can be controlled by

    (A) Adding alkali salts   (B) Addition of ammonia

    (C) Removing oxygen   (D) All of the above

47. The favourable conditions for scale formation in boilers is/are
   (A) Increase of solubility of salts with increase of temperature
   (B) Decrease of solubility of salts with increase of temperature
   (C) None of the above
   (D) All of the above

48. Which of the following is/are correct about zeolites
   (A) Zeolites reduce alkalinity / Total solids of boiler feed water
   (B) They almost completely remove hardness of feed water
   (C) Both A & B
   (D) Neither A nor B

49. Water high in carbonates can be softened easily without replacing the water with some other salts by
   (A) Lime soda softening process   (B) Hot process phosphate softening
   (C) Zeolite processes   (D) All of the above

50. Which of the following statements regarding boiler mounting is true?
   (A) They ensure safe operation of the boiler
   (B) They are installed to increase the efficiency of the boiler
   (C) Air pre-heater, economizer are boiler mountings
   (D) Pressure gauge is not a boiler mounting

51. A lever safety valve used on steam boiler is
   (A) Measure the pressure of the steam inside the steam boiler
   (B) Maintaining constant safe pressure inside the steam boiler
   (C) To control the flow of steam from the boiler
   (D) To increase the temperature of steam

52. In which type safety valve is used in a stationary boiler?
   (A) High steam low water safety valve
   (B) Lever safety valve
   (C) Dead weight safety valve
   (D) Spring loaded safety valve

53. A device used to heat feed water by utilising the heat in the exhaust flue gases
   (A) Feed pump   (B) Blow off cock
   (C) Ecnomizer   (D) Fusible plug

54. In which type pressure gauges are generally used in steam boiler?

   (A) U tube type   (B) Bourdon type

   (C) Diaphram type   (D) Differential type

55. In water level indicator how many water level devices are used?

   (A) 1   (B) 3

   (C) 2   (D) 4

56. In which boiler mountings are used to protect the fire tube?

   (A) Blow off cock   (B) Fusible plug   (C) Safety valve   (D) Ecnomizer

57. Which of the following is not a boiler accessory?

   (A) Water level indicator   (B) Superheater

   (C) Ecnomizer   (D) Air preheater

58. A super heater used in the steam boiler is

   (A) To increase the pressure of the steam inside the boiler

   (B) To increase the temperature of saturated steam

   (C) To heat feed water

   (D) To increase the steam raising capacity of the boiler

59. An air preheater is installed

   (A) Before the ecnomizer   (B) Before the superheater

   (C) Between the ecnomizer and chimney   (D) Between the feed water pump

60. Blow off cock is used in a boiler to

   (A) Remove smoke in the boiler   (B) Remove impurities from the boiler

   (C) Remove ash in the boiler   (D) Remove steam in the boiler

61. Which of the following boiler mountings prevents the back flow of the water after pumping into the boiler?

   (A) Feed check valve   (B) Blow down valve

   (C) Stop valve   (D) Safety valve

62. Which of the following relatively employs highest heat transfer surface in a high pressure boiler?

   (A) Furnace water wall   (B) Superheater

   (C) Ecnomizer   (D) Air preheater

63. In a draught system fan is placed before the fire grate is called
    (A) Induced draught system
    (B) Balanced draught system
    (C) Forced draught system
    (D) Steam jet draught system

64. The efficiency of chimney is
    (A) one per cent
    (B) less than one per cent
    (C) greater than 1 per cent
    (D) zero per cent

65. The velocity of flue gases (V) through the chimney under static draught (H) meters is given by
    (A) $4.43\sqrt{H}$
    (B) 4.43 H
    (C) $(4.43H)^2$
    (D) $4.43(H)^2$

66. Which type of draught system is used in the locomotives?
    (A) Balanced draught system
    (B) Natural draught system
    (C) Forced draught system
    (D) Induced steam draught system

67. The ratio of chimney height to the hot gas coloumn producing draught for the maximum discharge of flue gas through chimney is
    (A) 0.5
    (B) 1
    (C) 2
    (D) 4

68. In an induced steam jet draught system, the steam jet issuing from nozzle is placed in
    (A) Furnace
    (B) Chimney
    (C) Ash pit
    (D) Fire grate

69. A draught produced by the chimney due to the difference of densities between the hot gases inside the chimney and cold atmosphere air outside is called
    (A) Forced draught system
    (B) Natural draught system
    (C) Induced draught system
    (D) Balanced draught system

70. Which of the following statements is wrong?
    (A) The mechanical draught reduces the height of the chimney
    (B) The natural draught reduces the fuel consumption
    (C) A balanced draught is a combination of induced and forced draught system
    (D) All of the above

71. The height of the chimney (H) and the atmosphere temperature (T_1) then the draught pressure for maximum discharge
    (A) $176.5\ H^2/T_1$ mm of water
    (B) $176.5\ H/T_1$ mm of water
    (C) $176.5\ H/T_1^2$ mm of water
    (D) $176.5\ T_1/H$ mm of water

72. The boiler draught is

    (A) The flow of adequate supply of steam

    (B) The difference of pressure is maintained above and below the fire grate

    (C) The flow of adequate quantity of water in the boiler

    (D) The pressure maintained in the chimney

73. The factor of evaporation of boiler is

    (A) Unity   (B) Less than unity

    (C) Zero   (D) Greater than unity

74. When the enthalpy of steam is h KJ/Kg and the enthalpy of feed water is hf_1 KJ/Kg then the factor of evaporation is given by

    (A) $h - hf_1/2257$ (B) $h + hf_1/2257$

    (C) $h \cdot hf_1/2257$ (D) $h / hf_1 \times 2257$

75. The performance of a steam boiler is measured in terms of its

    (A) Feed water temperature   (B) Working pressure

    (C) Fuel   (D) Evaporative capacity

76. Heat balance sheet of a steam boiler shows

    (A) Overall efficiency of the boiler

    (B) Percentage of available heat utilised

    (C) Complete account of heat supplied by 1 Kg of dry fuel and heat consumed

    (D) Thermal efficiency of the boiler

77. The main objectives of a boiler trial are:

    (A) To determine the feed water temperature

    (B) To determine the generating capacity of the boiler

    (C) To determining the overall efficiency of the boiler

    (D) To determining the temperature of steam produced

78. Boiler efficiency does not depend on

    (A) Calorific value of fuel used   (B) Specific heat of steam generated

    (C) Boiler design   (D) Operating time

79. The evaporative capacity of a steam boiler is expressed in

    (A) Kg/hr of fuel burned   (B) Kg/Kg of fuel burned

    (C) Kg.hr/Kg of fuel burned   (D) KJ/Kg of fuel burned

80. In a boiler various heat losses take place. The biggest loss is due to

    (A) Moisture in fuel   (B) Dry flue gases

    (C) Steam formation   (D) Unburnt carbon

81. Which of the following is a primary fuel?

    (A) Lignite coal   (B) Coke

    (C) Charcoal   (D) Briquettes

82. The most suitable solid fuel for steam generation is

    (A) Peat   (B) Brown coal

    (C) Bituminous coal   (D) Anthracite

83. By passing steam over incandescent coke can produce

    (A) Producer gas   (B) Water gas

    (C) Mond gas   (D) Blast furnace gas

84. If the fuel contains oxygen then as per Dulong's formula it is assumed that the whole amount is combined with hydrogen having mass equal to

    (A) (1/9) th of oxygen   (B) (1/8) th of oxygen

    (C) 9 times oxygen   (D) 8 times oxygen

85. LCV of a fuel can be found by subtracting heat of steam formed during combustion from HCV, where mass of steam formed in kg per kg of fuel is equal to

    (A) $9 H_2$ (B) $8 H_2$

    (C) $1/9 H_2$ (D) $1/8 H_2$

86. Bomb calorimeter can be used to find the calorific value of

    (A) Liquid fuels only   (B) Solid fuels only

    (C) Both liquid and solid fuels   (D) Gaseous fuels only

87. Cover of the bomb calorimeter has

    (A) One valve   (B) Two valves

    (C) Three valves   (D) No valves

88. Higher calorific value is for

    (A) Petrol   (B) Paraffins

    (C) Diesel oil   (D) Heavy fuel oil

89. The gas which is obtained by the carbonisation of bituminous coal

    (A) Mond gas   (B) Blast furnace gas

    (C) Producer gas   (D) Coke oven gas

90. Which hydrocarbons have chain structure?

(A) Paraffins
(B) Naphthalenes
(C) Benzene
(D) None of these

91. In a given combustion process

(i) The maximum temperature achieved through adiabatic complete combustion varies with the type of reaction and percent of theoretical air supplied.

(ii) An increase in the air fuel ratio will effect an increase in the maximum temperature

(iii) For a given fuel and a given pressure and temperature of the reactants, the maximum adiabatic flame temperature that can be achieved is with a stoichiometric mixture.

Which of these statements are correct?

(A) Only (i) and (ii)
(B) Only (ii) and (iii)
(C) Only (i) and (iii)
(D) All are correct

92. If a coal sample gave the analysis by weight of carbon 84% minimum weight of oxygen required per kg of coal for complete combustion is

(A) 2.24 kg
(B) 0.32 kg
(C) 3.08 kg
(D) None of these

93. Weight of dry flue gas per kg of fuel is

(A) Weight of carbon in 1 kg of fuel to the weight of carbon in 1 kg of flue gas
(B) Weight of carbon in 1 kg of flue gas to the weight of carbon in 1 kg of fuel
(C) Weight of oxygen in 1 kg of flue gas to the weight of carbon in 1 kg of fuel
(D) Weight of oxygen in 1 kg of fuel to the weight of carbon in 1 kg of flue gas

94. For complete conversion to water or steam, 1 kg of hydrogen requires

(A) 4 kg of oxygen
(B) 8 kg of oxygen
(C) 9 kg of oxygen
(D) None of these

95. Mass of carbon contained in 1 kg of flue gas is calculated from

(A) Mass of carbon dioxide and mass of carbon monoxide present in them
(B) Mass of carbon dioxide and mass of oxygen in them
(C) Mass of carbon monoxide and mass of oxygen in them
(D) None of these

96. To ensure complete combustion of fuel, modern tendency is to use
    (A) 5 to 8% of excess air
    (B) 8 to 15% of excess air
    (C) 15 to 25% of excess air
    (D) 25 to 50% of excess air

97. Caustic soda and pyrogallic acid is used in one flask of the Orsat apparatus to determine the constituents of the flue gases which will absorb
    (A) Carbon dioxide
    (B) Oxygen
    (C) Carbon monoxide
    (D) None of these

98. Maximum loss of heat in a boiler is due to
    (A) Dry flue gases
    (B) Steam formed by combustion of hydrogen
    (C) Moisture in fuel
    (D) Incomplete combustion of carbon to carbon monoxide

99. The main objects of boiler trial are

    (i) To determine the generating capacity of the boiler

    (ii) To determine the thermal efficiency of the boiler when working at a definite pressure

    (iii) To prepare heat balance sheet for the boiler

    Which of these statements are correct?
    (A) Only (i) & (ii)
    (B) All of the above (i), (ii) & (iii)
    (C) Only (i) & (iii)
    (D) Only (ii) & (iii)

100. Which of the following conditions should satisfy a reversible process?

    (i) The process should not involve friction of any kind

    (ii) Heat transfer should take place with finite temperature difference

    (iii) There should be no free or unrestricted expansion

    Which of these statements are correct?
    (A) Only (i) and (ii)
    (B) Only (ii) and (iii)
    (C) All of the above (i), (ii) and (iii)
    (D) Only (i) and (iii)

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SPACE FOR ROUGH WORK