Post Graduate School
Indian Agricultural Research Institute, New Delhi

Examination for Admission to Ph.D. Programme 2011-2012

Discipline : Plant Physiology

Discipline Code : 18

Roll No

Please Note:

(i) This question paper contains 12 pages. **Please check whether all the pages are printed in this set.** Report discrepancy, if any, **immediately** to the invigilator.

(ii) ***There shall be NEGATIVE marking for WRONG answers in the Multiple Choice type questions (No. 1 to 130) which carry one mark each. For every wrong answer 0.25 mark will be deducted.***

PART – I (General Agriculture)

Multiple choice questions (No. 1 to 30). Choose the correct answer (*a, b, c* or *d*) and enter your choice in the circle (by shading with a pencil) on the OMR - answer sheet as per the instructions given on the answer sheet.

1. Which of the following crops have been approved for commercial cultivation in India?
a) Bt cotton and Bt brinjal
b) Bt cotton and Golden Rice
c) Bt maize and Bt cotton
d) Bt cotton only

2. This year (2010-11) the expected food grain production in India is
a) 212 million tonnes
b) 220 million tonnes
c) 235 million tonnes
d) 250 million tonnes

3. The genome of which of the following crops is still not completely sequenced?
a) Rice
b) Soybean
c) Sorghum
d) Wheat

4. According to the Approach Paper to the 12th Five Year Plan, the basic objective of the 12th Plan is
a) Inclusive growth
b) Sustainable growth
c) Faster, more inclusive and sustainable growth
d) Inclusive and sustainable growth

5. To address the problems of sustainable and holistic development of rainfed areas, including appropriate farming and livelihood system approaches, the Government of India has set up the
a) National Rainfed Area Authority
b) National Watershed Development Project for Rainfed Areas
c) National Mission on Rainfed Areas
d) Command Area Development and Water Management Authority

6. Which of the following sub-schemes are not covered under the Rashtriya Krishi Vikas Yojana?
a) Extending the Green Revolution to eastern India
b) Development of 60,000 pulses and oilseeds villages in identified watersheds
c) National Mission on Saffron
d) National Mission on Bamboo

7. The minimum support price for the common variety of paddy announced by the Government of India for the year 2010-11 was
a) ₹ 1030
b) ₹ 1000
c) ₹ 980
d) ₹ 950

8. According to the Human Development Report 2010 of the United Nations, India's rank in terms of the human development index is
a) 119
b) 134
c) 169
d) 182

9. Which of the following does not apply to SRI method of paddy cultivation?
a) Reduced water application
b) Reduced plant density
c) Increased application of chemical fertilizers
d) Reduced age of seedlings

10. Which organic acid, often used as a preservative, occurs naturally in cranberries, prunes, cinnamon and cloves?
a) Citric acid
b) Benzoic acid
c) Tartaric acid
d) Lactic acid

11. Cotton belongs to the family
a) Cruciferae
b) Anacardiaceae
c) Malvaceae
d) Solanaceae

12. Photoperiodism is
a) Bending of shoot towards source of light
b) Effect of light/dark durations on physiological processes
c) Movement of chloroplast in cell in response to light
d) Effect of light on chlorophyll synthesis

13. Ergot disease is caused by which pathogen on which host?
a) *Claviceps purpurea* on rye
b) *Puccinia recondita* on wheat
c) *Drechlera sorokiniana* on wheat
d) *Albugo candida* on mustard

14. Rocks are the chief sources of parent materials over which soils are developed. Granite, an important rock, is classified as
a) Igneous rock
b) Metamorphic rock
c) Sedimentary rock
d) Hybrid rock

15. Which one of the following is a *Kharif* crop?
a) Pearl millet
b) Lentil
c) Mustard
d) Wheat

16. The coefficient of variation (C.V.) is calculated by the formula
a) (Mean/S.D.) × 100
b) (S.D./Mean) × 100
c) S.D./Mean
d) Mean/S.D.

17. Which of the following is commonly referred to as muriate of potash?
a) Potassium nitrate
b) Potassium chloride
c) Potassium sulphate
d) Potassium silicate

18. Inbred lines that have same genetic constitution but differ only at one locus are called
a) Multi lines
b) Monohybrid
c) Isogenic lines
d) Pure lines

19. For applying 100 kg of nitrogen, how much urea would one use?
a) 45 kg
b) 111 kg
c) 222 kg
d) 333 kg

20. The devastating impact of plant disease on human suffering and survival was first realized by epidemic of
a) Brown spot of rice in Bengal
b) Late blight of potato in USA
c) Late blight of potato in Europe
d) Rust of wheat in India

21. The species of rice (*Oryza*) other than *O. sativa* that is cultivated is
a) *O. rufipugon*
b) *O. longisteminata*
c) *O. glaberrima*
d) *O. nivara*

22. The enzyme responsible for the fixation of CO_2 in mesophyll cells of C-4 plants is
a) Malic enzyme
b) Phosphoenol pyruvate carboxylase
c) Phosphoenol pyruvate carboxykinase
d) RuBP carboxylase

23. Which one of the following is a 'Vertisol'?
a) Black cotton soil
b) Red sandy loam soil
c) Sandy loam sodic soil
d) Submontane (Tarai) soil

24. What is the most visible physical characteristic of cells in metaphase?
a) Elongated chromosomes
b) Nucleus visible but chromosomes not
c) Fragile double stranded loose chromosomes
d) Condensed paired chromosomes on the cell plate

25. All weather phenomena like rain, fog and mist occur in
a) Troposphere
b) Mesosphere
c) Ionosphere
d) Ozonosphere

26. Which of the following elements is common to all proteins and nucleic acids?
a) Sulphur
b) Magnesium
c) Nitrogen
d) Phosphorous

27. Silt has intermediate characteristics between
a) Sand and loam
b) Clay and loam
c) Loam and gravel
d) Sand and clay

28. Certified seed is produced from
a) Nucleus seed
b) Breeder seed
c) Foundation seed
d) Truthful seed

29. Seedless banana is an
a) Autotriploid
b) Autotetraploid
c) Allotriploid
d) Allotetraploid

30. Which one of the following is used to test the goodness-of-fit of a distribution?
a) Normal test
b) t-test
c) Chi-square test
d) F-test

PART – II (Subject Paper)

Multiple choice questions (No. 31 to 130). Choose the correct answer (*a, b, c* or *d*) and enter your choice in the circle (by shading with a pencil) on the OMR - answer sheet as per the instructions given on the answer sheet.

31. Primary electron acceptor from PSI is
a) Pheophytin
b) A_0
c) Q_A
d) A_1

32. Ni is essential component of enzyme
a) Nitrogenase
b) Catalase
c) Urease
d) Peroxidase

33. Concept of LAD was given by
a) Peter Mitchell
b) D.J. Watson
c) V.H. Blackman
d) F.G. Gregory

34. Aquaporins are
a) Integral membrane proteins
b) Peripheral membrane proteins
c) Integral phospholipids
d) Peripheral phospholipids

35. Complete oxidation of one molecule of pyruvate via Krebs cycle will generate
a) 2 NADH, 1 $FADH_2$, 2 ATP
b) 4 NADH, 1 $FADH_2$, 1 ATP
c) 2 NADH, 1 $FADH_2$, 2 ATP
d) 1 NADH, 1 $FADH_2$, 4 ATP

36. Stem elongation in deep water rice is caused by
a) GA
b) Auxin
c) Phytochrome
d) C_2H_4

37. Sorghum plant comes under the category of
a) NAD malic enzyme type
b) C_3-C_4 intermediate
c) PEP-carboxykinase
d) NADH malic enzyme type

38. Infrared absorption band of CO_2 is at
a) 1.26 μm
b) 2.26 μm
c) 3.26 μm
d) 4.26 μm

39. In plant system, heat dissipation is mediated by a pigment called
a) Phytochrome
b) Zeaxanthin
c) Carotene
d) Lycopene

40. Mutants of nitrate transport can be selected by growing the plants on media supplemented with
a) Ammonia
b) Nitrate
c) Chlorate
d) Nitrite

41. Practically all sugar found in plants is of
a) L form
b) D form
c) L+D form
d) L and D present in equal amount

42. Which of the following is not an inhibitor of ethylene action?
a) Silver
b) 1-MCP
c) Mercuric perchlorate
d) 2,5 norbornadiene

43. To fix one molecule of CO_2 Calvin cycle requires
a) 3 ATP and 2 NADPH
b) 2 ATP and 3 NADPH
c) 2 ATP and 2 NADPH
d) 3 ATP and 3 NADPH

44. Which of the following is true for sieve tube elements?
a) They have plenty of ribosomes
b) They have more mitochondria
c) They are not dependent on any other cell
d) They lack nucleus

45. Plant parts which transpire relatively little develop the deficiency of
a) K
b) P
c) Ca
d) N

46. The most basic precursor for the synthesis of lignin is
a) Phenylalanine and/or tyrosine
b) t-cinnamic acid
c) Caffiec acid
d) 4-coumaric acid

47. What is the pH of Hoagland solution?
a) 5.5
b) 5.6
c) 5.7
d) 5.8

48. Which of the following statement is true?
a) CO_2 compensation point is high for C_4 plants
b) Chloroplast dimorphism is present in C_3 plants
c) Warburg effect (leaf) is high in C_4 plants
d) ^{13}C discrimination is low in C_4 plants

49. UV-B radiation is represented by a range of
a) 200-280 nm
b) 200-400 nm
c) 280-320 nm
d) 320-400 nm

50. Triacylglycerols are stored in
a) Peroxisomes
b) Oleosomes
c) Glyoxysomes
d) Endoplasmic reticulum

51. Chemically GA is
a) Triterpene
b) Tetraterpene
c) Isoprene
d) Diterpene

52. Permanent wilting point corresponds to the soil water potential value of
a) -10 bars
b) -15 bars
c) -20 bars
d) -25 bars

53. Tritium atom is made up of
a) One proton, one electron, one neutron
b) One proton, one electron, two neutron
c) One proton, one electron, three neutron
d) Three proton, three electron, three neutron

54. Which of the following is not a domain/ cofactor for nitrate reductase enzyme?
a) Cyt b
b) Cyt c
c) FAD
d) Mo cofactor

55. Which of the following amino acid does not use aspartate as its precursor?
a) Threonine
b) Methionine
c) Lysine
d) Histidine

56. Which of the following is not required for activation of rubisco?
a) 3-PGA
b) Mg
c) ATP
d) CO_2

57. Plants exposed to higher levels of SO_2 pollution show deficiency symptoms of
a) Ca and B
b) K and Mg
c) N and P
d) Fe and Zn

58. They serve as signal for interactions of the plants with symbionts
a) Phytosiderophores
b) Flavonoids
c) Isoprene
d) Jasmonic acid

59. It is not true about anthocyanins
a) Accumulate in vacuole
b) Show change in colour with change in pH
c) Peroxide protection against excess light
d) Stresses like chilling and P deficiency cause their destruction

60. Which of the following metabolites involved in energy metabolism, is also starting point for the synthesis of ABA, GA and cytokinins?
a) Glucose
b) Fructose
c) Sucrose
d) Acetyl CoA

61. Biosynthesis of aromatic amino acids takes place in
a) Glyoxysome
b) Plastid
c) Mitochondria
d) Cytosol

62. Salicylic acid causes
a) Thermogenesis in lilies
b) Senescence of petals
c) Positive effect on C_2H_4 biosynthesis
d) Inhibition of flowering in duck weeds

63. Plasma membrane potential of plant cell is normally about
a) -15 mV
b) -50 mV
c) -150 mV
d) -250 mV

64. Primary mode of action of fusicoccin is stimulation of
a) K channel
b) Rapid entry of H_2O in cell
c) Plasma membrane H^+-ATPase
d) Tonoplast H^+-ATPase

65. NADH cytochrome C reductase is marker enzyme for
a) Tonoplast
b) Plasma membrane
c) Peroxisome
d) ER

66. Main lipid in mitochondrial membrane is
a) Cardiolipin
b) Phosphatidyl glycerol
c) Monogalactosyl diacylglycerol
d) Phosphatidyl choline

67. Which of the following is not a function of ABA?
a) Dormancy induction
b) Causing abscission
c) Seed maturation
d) Stomatal closure

68. Which of the following process is not associated with production of superoxide anion?
a) β-oxidation
b) Photorespiration
c) Photosynthetic electron transport under stress
d) Defence against pathogen

69. During freezing stress ice formation is initiated first in
a) Intercellular spaces
b) Cytosol
c) Symplastic regions
d) Vacuole

70. Enzyme Catalase is absent in
a) Cytosol
b) Plastid
c) Glyoxysome
d) Peroxisome

71. Which of the following is not true?
a) Pfr form of phytochrome promotes flowering in LDP
b) Dark break is effective in promotion of flowering in SDP
c) Phytochrome is a pigment
d) Light break inhibits flowering in SDP

72. Isotopes of an element are atoms with
a) Different atomic number but same mass number
b) Same atomic number but different mass number
c) Different atomic number and mass number
d) Same atomic number as well as mass number

73. Which Oligomeric form of Rubisco is correct?
a) L_2S_2
b) L_4S_4
c) L_6S_6
d) L_8S_8

74. 1% solution of a chemical is
a) 10,000 ppm
b) 1,000 ppm
c) 100 ppm
d) 10 ppm

75. The water potential and osmotic potential of pure water is
a) 100 and 100
b) Zero and 100
c) Zero and zero
d) 100 and zero

76. Who proposed the 'Transpiration pull and cohesion' theory?
a) Westermaier
b) Godlewski
c) Dixon and Jolly
d) Sir J.C. Bose

77. Electron donor for the reduction of dinitrogen in nitrogen fixing organisms is
a) NADH
b) Ferredoxin
c) Cytochrome
d) ATP

78. Plasmolysis occurs due to
a) Exosmosis
b) Endosmosis
c) Presence of solutes
d) Semi-permeability of membrane

79. Substrate for photorespiration is
a) Glycolate
b) Oxaloacetate
c) PEP
d) Phosphoglyceraldehyde

80. In photosynthesis O_2 is evolved from
a) 3 PGA
b) CO_2
c) Water
d) RuBP

81. C_3 pathway of photosynthesis was discovered by
a) Sir H. Krebs
b) M. Calvin
c) M.D. Hatch and C.R. Slack
d) Sir J.C. Bose

82. Which of the parameters is called as the 'Efficiency index'?
a) Leaf area index
b) Net assimilation rate
c) Relative growth rate
d) Leaf area ratio

83. Time gap between initiation of two adjacent leaves is called
a) Phytochrome
b) Leaf area index
c) Leaf area ratio
d) Plastochron

84. Economic yield of a crop is 6t/ha. If its biological yield is 18 t/ha, how much will be the harvest index?
a) 0.66
b) 3.3
c) 0.33
d) 0.033

85. LAI of 2 means
a) One square metre of leaf area in 2 square metre of land area
b) Two square metre of leaf area in one square metre of land area
c) Ratio of leaf area to leaf weight is 2
d) Ratio of maximum leaf area to leaf area at harvest is 2

86. Apparent free space is
a) Intercellular space
b) Part of plant cell or tissue which allows for free diffusion of ions
c) Part of plant cell or tissue which allows an active uptake of ions
d) Space in a tissue in which ions accumulate after diffusion

87. Inactivation of ABA in plant is caused by conversion of ABA to
a) Phaseic acid
b) Violoxanthin
c) Zeaxanthin
d) Xanthoic acid

88. Growth hormones generally associated with apical dominance are
a) ABA
b) Gibberellins
c) Cytokinins
d) Auxins

89. From the options given below, choose both of which generally promote elongation of cells and induce parthenocarpy
a) Auxins and gibberellins
b) Auxins and ABA
c) ABA and cytokinins
d) Ethylene and ABA

90. The microbial oxidation of NH_4^+ to form NO_3^- is called
a) Mineralization
b) Nitrification
c) Denitrification
d) N fixation

91. Reaction involving transfer of an amino group of an amino acid to the carboxyl group of a ketoacid giving rise to an amino acid is called
a) Peptide bond formation
b) Translation
c) Transamination
d) Transcription

92. In the plants, ethylene is synthesized from
a) Ethrel
b) Methionine
c) Ethephon
d) Tryptophan

93. Prof. J.J. Chinoy is known for his work on
a) Flowering
b) Growth analysis
c) Ascorbic acid
d) Plant growth substances

94. Photoinhibtion is a complex set of molecular processes, defined as the inhibition of photosynthesis by excess light. Which protein of the PSII reaction centre complex is the main target of this damage?
a) D1
b) D2
c) LHC II
d) Nonheme protein

95. Some solar-tracking plants can move their leaves such that they avoid full exposure to sunlight thus minimising heating and water loss. The term which is often used to describe sun-induced leaf movement is
a) Phototropism
b) Heliotropism
c) Thigmotropism
d) Phototropism

96. Name the non-reducing sugar from the followings:
a) Sucrose
b) Glucose
c) Fructose
d) Mannose

97. The six-carbon glucose-6-phosphate is initially oxidised to the five-carbon ribulose-5-phosphate by the process
a) Glycolysis
b) Citric acid cycle
c) Pentose phosphate pathway
d) Oxidative phosphorylation

98. Name the precursor of Indole acetic acid
a) Methionine
b) Tryptophan
c) Histidine
d) Serine

99. The dye used for testing the viability of seeds is
a) 1,2,6 dichlorophenol indophenol
b) 2,3,5 triphenyltetrazolium chloride
c) Safranine
d) 2,3,5,7 tetraphenyl tetrazolium chloride

100. Scintillation counter is used for the measurement of
a) β-radiation
b) Number of hydrogen atoms in a compound
c) Number of hydrogen bonds in a compound
d) γ-radiation

101. An allosteric modulator influences enzyme activity by
a) Competing for the catalytic site with the substrate
b) Binding to the site of the enzyme molecule distinct from the catalytic site
c) Changing the nature of the product formed
d) Changing the specificity of the enzyme for its substrate

102. The ionizable tracking dye used in protein electrophoresis is
a) Amido black
b) Bromocresol green
c) Bromophenol blue
d) Methyl red

103. Plant that flowers in response to a single inductive cycle
a) *Xanthium strumarium*
b) *Kalanchoe*
c) *Avena sativa*
d) *Petunia hybrida*

104. Osmotic adjustment is due to the accumulation of
a) Amino acids
b) Ions
c) Sucrose
d) All of the above

105. Chloroplast membranes are rich in
a) Galactolipids
b) Sulpholipids
c) Phospholipids
d) Sterols

106. Which one of the following is an imino acid?
a) Cysteine
b) Proline
c) Leucine
d) Alanine

107. Which one of the following is not a naturally occurring auxin?
a) Indole acetic acid
b) α-naphthalene acetic acid
c) Phenyl acetic acid
d) Indole butyric acid

108. The only reaction in the citric acid cycle that produces a substrate level phosphorylation is catalysed by
a) Succinyl CoA synthetase
b) Pyruvate dehydrogenase
c) Citrate synthetase
d) α-ketogentorate dehydrogenase

109. The enzymes specific to glyoxylate cycle are
a) Isocitrate lyase and PEP carboxylase
b) Malate synthetase and malic enzyme
c) Isocitrate lyase and malic enzyme
d) Isocitrate lyase and Malate synthetase

110. Which of the following compounds serve as an acceptor for the amino groups of many amino acids during catabolism?
a) Glutamine
b) Asparagine
c) α-ketoglutarate
d) Oxalate

111. Oxidation and reduction of copper is critical to the function of
a) Ferredoxin
b) O_2 evolving complex
c) Plastocyanin
d) Pheophytin

112. The effect of expression of an antisense stearoyl ACP desaturase gene in a seed would be to increase
a) Linolenic acid
b) Linoleic acid
c) Oleic acid
d) Stearic acid

113. High resolution in HPLC is because
a) High pressure is applied during chromatography
b) Steel column is used for separation
c) Superfine particles of stationary phase are used in HPLC
d) Elution is carried out by degasified eluant

114. Leaf water potential is measured with the help of
a) Leaf area meter
b) Porometer
c) Pressure chamber
d) Spectrophotometer

115. Glyphosate is the competitive inhibitor of
a) GS
b) EPSP synthase
c) Shikimate kinase
d) GOGAT

116. Inhibitors of the chloroplast, electron transport chain does not include
a) DCMU
b) DBMIB
c) Malonate
d) Paraquat

117. Which one of the following enzyme is not associated with photorespiration?
a) Rubisco
b) Glycolate oxidase
c) Glyceraldehyde-3-P dehydrogenase
d) Glycine decarboxylase

118. Which one of the following compounds is not a polyamine?
a) Spermidine
b) Arginine
c) Puterescine
d) Spermine

119. Middle lamella is present between
a) Primary cell walls of adjacent cells
b) Secondary cell walls of adjacent cells
c) Primary and secondary cell walls of the cell
d) Secondary cell wall and plasma membrane of the cell

120. Major determinant of soil water potential is
a) Osmotic potential
b) Matric potential
c) Gravitational potential
d) Osmotic pressure

121. What will be the water potential of a isotonic solution for a cell which has osmotic potential and pressure potential of the magnitude of -0.4 and 0.2 MPa, respectively?
a) -0.2 MPa
b) +0.2 MPa
c) -0.6 MPa
d) +0.6 MPa

122. For a leaf under normal condition
a) gs H_2O = gs CO_2
b) gs H_2O > gs CO_2
c) gs H_2O < gs CO_2
d) No definite relation exists between gs H_2O and gs CO_2

123. Casparian strip is present in
a) Epidermis
b) Pericycle
c) Endodermis
d) Xylem

124. Polysaccharide callose is associated with
a) Middle lamella
b) Sieve plate
c) Cutin
d) Casparian strip

125. During light reaction of photosynthesis, the pH of
a) Thylakoid lumen becomes acidic and stroma basic
b) Thylakoid lumen becomes basic and stroma acidic
c) Thylakoid lumen and stroma, both becomes acidic
d) Thylakoid lumen and stroma, both becomes basic

126. The enzyme which catalyzes following reaction:
$Malate+NADP^+ \rightarrow Pyruvate+CO_2+NADPH+H^+$
a) Malic dehydrogenase
b) Malic enzyme
c) Malate reductase
d) Malate carboxylase

127. The rubisco acts most efficiently at
a) pH 5
b) pH 7
c) pH 8
d) pH 10

128. Precursor of starch biosynthesis in wheat grain is
a) ADP glucose
b) UDP glucose
c) ADP fructose
d) UDP fructose

129. The site of nitrite reduction in plant leaves is
a) Cytoplasm
b) Mitochondria
c) Chloroplast
d) Microsomes

130. Chemically essential oils are
a) Saturated triglycerides
b) Highly unsaturated triglycerides
c) Fatty alcohols
d) Terpenoids

Matching type questions (No. 131 to 140); all questions carry equal marks. Choose the correct answer (*a, b, c, d* or *e*) for each sub-question (*i, ii, iii, iv* and *v*) and enter your choice in the circle (by shading with a pencil) on the OMR - answer sheet as per the instructions given on the answer sheet.

131. Link the following with physiological processes

i) Gibbs effect	a) Photosynthetic enhancement
ii) Kautsky effect	b) Photosynthesis
iii) Blinks effect	c) Asymmetric distribution of radiocarbon in glucose
iv) Pasteur effect	d) Respiration
v) Emerson effect	e) Chlorophyll fluorescence

132. Match the following with their functions

i) Parenchyma	a) Filling, packing, storage
ii) Collenchyma	b) Providing strength and support with rigidity
iii) Sclerenchyma	c) Air paces between parenchymatous cells
iv) Chlorenchyma	d) Parenchymatous cells of leaves
v) Aerenchyma	e) Providing strength without rigidity

133. Match the measurements with equipments/ methods

i) Protein legand interaction	a) Infrared gas analyzer
ii) Rate of photosynthesis	b) Planimeter
iii) Transpiration rate	c) Patch-clamp
iv) Leaf area	d) Isothermal titration calorimetry
v) Ion channel	e) Porometer

134.

i) Cardiolipin	a) Stroma of chloroplast
ii) Oleosin	b) Tonoplast protein
iii) Δ^9-Seroyl ACP-desaturase	c) Mitochondrial membrane
iv) α-TIP	d) Ureide
v) Allantoin	e) Oil body

135.

i) Hatch and Slack	a) Water potential
ii) Peter Mitchell	b) Photoperiodism
iii) Slatyer	c) Chemiosmotic hypothesis
iv) Tolbert	d) C_4 pathway
v) W.W. Garner and H.A. Allard	e) Photorespiration

136.

i) ABA	a) Nastic movements
ii) Ethylene	b) Stomatal closure
iii) Cytokinins	c) Chloroplast movement
iv) Turgorins	d) Epinasty
v) Cryptochrome	e) Inhibition of senescence

137.

i) Gibberellic acid	a) Transport inhibitor response 1
ii) Ethylene	b) Pyrabactin resistance 1
iii) ABA	c) CTR 1 kinase
iv) Indole acetic acid	d) Histidine kinase
v) Cytokinin	e) DELLA protein

138.

i) Photosynthesis rate	a) $\mu Em^{-2}s^{-1}$
ii) Photosynthetic photon flux	b) MPa
iii) Stomatal resistance	c) $\mu mol\ CO_2\ m^{-2}s^{-1}$
iv) Radiation flux	d) $S\ cm^{-1}$
v) Water potential	e) $J\ m^{-2}s^{-1}$

139. Match the following units to the plant growth analysis parameters

i) m^2kg^{-1} plant wt	a) CGR
ii) $g\ m^{-2}$ land area. day^{-1}	b) LAR
iii) $g\ m^{-2}$ leaf area. day^{-1}	c) RGR
iv) $mg\ g^{-1}\ day^{-1}$	d) NAR
v) $m^2\ kg^{-1}$ leaf wt	e) SLA

140.

i) Endoplasmic reticulum	a) Nuclear localization signal
ii) Chloroplast	b) HSP 70
iii) Mitochondrion	c) Signal peptide
iv) Molecular chaperons	d) Transit peptide
v) Transcription factor	e) Presequence

Short questions (No. 141 to 146); each question carries FIVE marks. Write answers, including computation / mathematical calculations if any, in the space provided for each question on the question paper itself.

141. If substrate (S) is broken down during respiration

$S + 4.5\ O_2 \rightarrow 6CO_2 + 4H_2O$

then find out RQ value. Can you predict the nature of substrate from this RQ value?

142. Briefly explain the cyanide resistant respiration and its significance.

143. Describe the xanthophyll cycles?

144. Write a brief note on the role of 'Mo' in nitrate assimilation and ABA synthesis.

145. In cell A, the water potential is –1.2 MPa and osmotic potential is –1.6 MPa. In cell B, the water potential is –1.5 MPa and the osmotic potential is –1.6 MPa. Calculate the turger potential in each cell and give the direction of movement of water.

146. Define programmed cell death. Enumerate four processes in which PCD is involved in plants?