XL-R: Q. 1 – Q. 10 carry one mark each & Q. 11 – Q. 20 carry two marks each.

Q.1 Which of the following genera produces dimorphic seeds that help to broaden the time of germination in a variable habitat?

(A) *Xanthium* (B) *Pisum* (C) *Mangifera* (D) *Linum*

Q.2 The genes for microRNA (miRNA) in plants are usually transcribed by

(A) RNA polymerase I
(B) RNA polymerase II
(C) RNA polymerase III
(D) RNA polymerase IV

Q.3 Which of the statements is **TRUE** for transposable elements *Ac* and *Ds*?

(A) Both *Ac* and *Ds* are autonomous because they encode their own transposase
(B) Both *Ac* and *Ds* are non-autonomous because they do not encode their own transposase
(C) Only *Ac* is autonomous because it encodes its own transposase
(D) Only *Ds* is autonomous because it encodes its own transposase

Q.4 Identify the **CORRECT** statement.

(A) Receptor-like kinases play role in gametophytic self-incompatibility in Brassicaceae
(B) Receptor-like kinases play role in sporophytic self-incompatibility in Solanaceae
(C) Ribonucleases play role in sporophytic self-incompatibility in Brassicaceae
(D) Ribonucleases play role in gametophytic self-incompatibility in Solanaceae

Q.5 Which of the following statements is **TRUE** for an ecotone?

(A) An ecotone is the synonym of an ecosystem
(B) An ecotone is an interface zone of two or more ecosystems
(C) An ecotone is a special feature of land biomes
(D) An ecotone is exclusively characterized by decreased biodiversity

Q.6 Acid rain with a pH of 4.0 is more acidic than the rain with a pH of 6.0 by

(A) 2 times (B) 10 times (C) 100 times (D) 1000 times

Q.7 Which of the following plants produces Ylang-ylang oil?

(A) *Cananga odorata*
(B) *Carcum copticum*
(C) *Pandanus odoratissimus*
(D) *Pimenta racemosa*

Q.8 Identify the **INCORRECT** statement in connection with polar transport of auxin.

(A) The putative influx carrier AUX1 is a cytosolic protein
(B) Polar auxin transport in root tends to be both acropetal and basipetal in direction
(C) Naphthylphthalamic acid (NPA) is an inhibitor of polar auxin transport
(D) AUX1 and PIN1 proteins are located in the opposite ends of a cell for polar transport

Q.9 Which of the following stains is used to visualize callose under the microscope?

(A) Alcian blue (B) Aniline blue (C) Toluidine blue (D) Thymol blue

Q.10 The coding sequence of a gene *XLR18* has the single ORF of 783 bp. The approximate molecular weight of the XLR18 protein in kDa is _____.

Q.11 Statements given below are either **TRUE** (**T**) or **FALSE** (**F**). Select the **CORRECT** combination.

P. Mitosis occurs exclusively in diploid mother cell
Q. Mitosis occurs both in diploid and haploid mother cells
R. Meiosis occurs exclusively in diploid mother cell
S. Meiosis occurs both in diploid and haploid mother cells

(A) P-T, Q-F, R-T, S-F (B) P-F, Q-T, R-F, S-T
(C) P-T, Q-F, R-F, S-T (D) P-F, Q-T, R-T, S-F

Q.12 You are asked to design a genetic construct for high-level expression of a gene encoding the therapeutic protein 18 (TP18) via plastid transformation. Select the **CORRECT** set of genetic elements for this construct.

(A) Actin1 promoter → TP18 coding sequence → Actin1 transcription terminator
(B) Ubiquitin1 promoter → TP18 coding sequence → Ubiquitin1 transcription terminator
(C) rbcS promoter → TP18 coding sequence → rbcS transcription terminator
(D) rbcL promoter → TP18 coding sequence → rbcL transcription terminator

Q.13 Select the **CORRECT** combination of the following statements.

P. The cyclic electron transport chain involving PSI results in net production of both ATP and NADPH
Q. The cyclic electron transport chain involving PSI results in net production of ATP
R. Rubisco enzyme usually converts RuBP and CO_2 into 2-phosphoglycolate and 3-phosphoglycerate
S. Rubisco enzyme usually converts RuBP and O_2 into 2-phosphoglycolate and 3-phosphoglycerate

(A) P, Q (B) R, S (C) Q, S (D) P, R

Q.14 Match the fruit characters with their families and representative plant species.

Fruit character	**Family**	**Plant species**
P. Syconus	1. Moraceae	i. *Canavalia ensiformis*
Q. Capsule, opening by apical pores or valves	2. Fabaceae	ii. *Artabotrys odoratissimus*
R. Legume	3. Papaveraceae	iii. *Ficus religiosa*
S. An etaerio of drupe	4. Annonaceae	iv. *Papaver somniferum*
		v. *Pistacia vera*
		vi. *Citrus aurantium*

(A) P-2-iv, Q-3-ii, R-1-vi, S-4-v
(B) P-1-iii, Q-3-iv, R-2-i, S-4-ii
(C) P-3-i, Q-2-iii, R-4-ii, S-1-vi
(D) P-4-v, Q-1-ii, R-2-v, S-3-i

Q.15 Select the **CORRECT** combination by matching the disease, affected plant and the causal organism.

Disease	**Affected plant**	**Causal organism**
P. Black rot	1. Corn	i. *Fusarium oxysporum* f.sp. *cubense*
Q. Loose smut	2. Banana	ii. *Acidovorax avenae* subsp. *citrulli*
R. Panama wilt	3. Watermelon	iii. *Botryosphaeria obtusa*
S. Bacterial fruit blotch	4. Apple	iv. *Ustilago maydis*
		v. *Plasmopara viticola*
		vi. *Venturia inaequalis*

(A) P-2-v, Q-1-iv, R-3-iii, S-4-vi
(B) P-2-ii, Q-1-i, R-4-iii, S-3-i
(C) P-4-iii, Q-1-iv, R-2-i, S-3-ii
(D) P-4-vi, Q-1-iii, R-3-ii, S-2-v

Q.16 Select the **CORRECT** combination by matching **Group-I** with **Group-II**.

Group-I	**Group-II**
P. Photorespiration	1. Glutamate → 2-Oxglutarate
Q. Respiration	2. Acetyl-CoA → Malonyl-CoA
R. Amino acid degradation	3. 2-Oxglutarate → Succinyl-CoA
S. Fatty acid synthesis	4. Glycine → Serine

(A) P-1, Q-2, R-3, S-4
(B) P-2, Q-1, R-4, S-1
(C) P-3, Q-4, R-2, S-3
(D) P-4, Q-3, R-1, S-2

Q.17 Match the plant alkaloids with their uses and source species.

Alkaloid	**Use**	**Source species**
P. Codeine	1. Stimulant	i. *Hyoscyamus niger*
Q. Caffeine	2. Analgesic	ii. *Catharanthus roseus*
R. Scopolamine	3. Antineoplastic	iii. *Cola nitida*
S. Vinblastine	4. Anticholinergic	iv. *Papaver somniferum*
		v. *Coptis japonica*
		vi. *Senecio jacobaea*

(A) P-2-iv, Q-1-iii, R-4-i, S-3-ii (B) P-4-iii, Q-2-v, R-1-vi, S-3-i
(C) P-2-v, Q-1-vi, R-3-iv, S-4-ii (D) P-3-ii, Q-4-iii, R-1-iv, S-2-i

Q.18 Identify the **CORRECT** combination of statements with respect to chemical defense in plants.

P. Pisatin, a phytoalexin produced by *Ricinus communis* is a constitutive defense compound
Q. *Phaseolus vulgaris* produces Phaseolus agglutinin I, which is toxic to the cowpea weevil
R. A single step non-enzymatic hydrolysis of cyanogenic glycoside releases the toxic hydrocyanic acid (HCN) to protect plant against herbivores and pathogens
S. Avenacin, a triterpenoid saponin from oat prevents infection by *Gaeumannomyces graminis*, a major pathogen of cereal roots

(A) P, Q (B) Q, S (C) R, S (D) P, S

Q.19 In garden pea, dwarf plants with terminal flowers are recessive to tall plants with axial flowers. A true-breeding tall plant with axial flowers was crossed with a true-breeding dwarf plant with terminal flowers. The resulting F_1 plants were testcrossed, and the following progeny were obtained:

Tall plants with axial flowers = 320
Dwarf plants with terminal flowers = 318
Tall plants with terminal flowers = 79
Dwarf plants with axial flowers = 83

The map distance between the genes for plant height and flower position is_____cM.

Q.20 Two true-breeding snapdragon (*Antirrhinum majus*) plants, one with red flowers and another with white flowers were crossed. The F_1 plants were all with pink flowers. When the F_1 plants were selfed, they produced three kinds of F_2 plants with red, pink and white flowers in a 1:2:1 ratio. The probability that out of the five plants picked up randomly, two would be with pink flowers, two with white flowers and one with red flowers is _____%.

END OF THE QUESTION PAPER

Q.No.	Type	Section	Key/Range	Marks
1	MCQ	GA	A	1
2	MCQ	GA	C	1
3	MCQ	GA	B	1
4	MCQ	GA	B	1
5	MCQ	GA	B	1
6	MCQ	GA	A	2
7	MCQ	GA	D	2
8	MCQ	GA	D	2
9	MCQ	GA	B	2
10	MCQ	GA	C	2
1	MCQ	XL-P	A	1
2	MCQ	XL-P	D	1
3	MCQ	XL-P	D	1
4	NAT	XL-P	11 to 11	1
5	NAT	XL-P	4 to 4	1
6	MCQ	XL-P	D	2
7	MCQ	XL-P	D	2
8	MCQ	XL-P	A	2
9	MCQ	XL-P	D	2
10	MCQ	XL-P	A	2
11	MCQ	XL-P	C	2
12	MCQ	XL-P	B	2
13	NAT	XL-P	1.39 to 1.43	2

Q.No.	Type	Section	Key/Range	Marks
14	NAT	XL-P	7.39 to 7.54	2
15	NAT	XL-P	-13.40 to -13.36	2
1	MCQ	XL-Q	B	1
2	MCQ	XL-Q	A	1
3	MCQ	XL-Q	C	1
4	MCQ	XL-Q	C	1
5	MCQ	XL-Q	D	1
6	MCQ	XL-Q	C	1
7	MCQ	XL-Q	D	1
8	MCQ	XL-Q	B	1
9	NAT	XL-Q	12 to 12	1
10	NAT	XL-Q	50 to 50	1
11	MCQ	XL-Q	A	2
12	MCQ	XL-Q	A	2
13	MCQ	XL-Q	D	2
14	MCQ	XL-Q	B	2
15	MCQ	XL-Q	B	2
16	NAT	XL-Q	512 to 512	2
17	NAT	XL-Q	20 to 20	2
18	NAT	XL-Q	0.8 to 0.8	2
19	NAT	XL-Q	77 to 77	2
20	NAT	XL-Q	-8862 to -8862	2
1	MCQ	XL-R	A	1

Q.No.	Type	Section	Key/Range	Marks
2	MCQ	XL-R	B	1
3	MCQ	XL-R	C	1
4	MCQ	XL-R	D	1
5	MCQ	XL-R	B	1
6	MCQ	XL-R	C	1
7	MCQ	XL-R	A	1
8	MCQ	XL-R	A	1
9	MCQ	XL-R	B	1
10	NAT	XL-R	28.00 to 31.00	1
11	MCQ	XL-R	D	2
12	MCQ	XL-R	D	2
13	MCQ	XL-R	C	2
14	MCQ	XL-R	B	2
15	MCQ	XL-R	C	2
16	MCQ	XL-R	D	2
17	MCQ	XL-R	A	2
18	MCQ	XL-R	B	2
19	NAT	XL-R	20.25 to 20.25	2
20	NAT	XL-R	11.00 to 12.00	2
1	MCQ	XL-S	B	1
2	MCQ	XL-S	A	1
3	MCQ	XL-S	A	1
4	MCQ	XL-S	D	1

Q.No.	Type	Section	Key/Range	Marks
5	MCQ	XL-S	D	1
6	MCQ	XL-S	C	1
7	MCQ	XL-S	D	1
8	MCQ	XL-S	B	1
9	MCQ	XL-S	A	1
10	NAT	XL-S	1.38 to1.42	1
11	MCQ	XL-S	C	2
12	MCQ	XL-S	C	2
13	MCQ	XL-S	A	2
14	MCQ	XL-S	D	2
15	MCQ	XL-S	B	2
16	MCQ	XL-S	A	2
17	NAT	XL-S	2.60 to 2.80	2
18	NAT	XL-S	0.5 to 0.5	2
19	NAT	XL-S	45.50 to 46.50	2
20	NAT	XL-S	30.5 to 31.5	2
1	MCQ	XL-T	C	1
2	MCQ	XL-T	B	1
3	MCQ	XL-T	A	1
4	MCQ	XL-T	D	1
5	MCQ	XL-T	C	1
6	MCQ	XL-T	D	1
7	MCQ	XL-T	B	1

Q.No.	Type	Section	Key/Range	Marks
8	MCQ	XL-T	A	1
9	MCQ	XL-T	A	1
10	MCQ	XL-T	C	1
11	MCQ	XL-T	B	2
12	MCQ	XL-T	D	2
13	MCQ	XL-T	C	2
14	MCQ	XL-T	C	2
15	MCQ	XL-T	B	2
16	MCQ	XL-T	D	2
17	MCQ	XL-T	C	2
18	MCQ	XL-T	A	2
19	NAT	XL-T	5270 to 5310	2
20	NAT	XL-T	0.056 to 0.062	2
1	MCQ	XL-U	B	1
2	MCQ	XL-U	A	1
3	MCQ	XL-U	C	1
4	MCQ	XL-U	A	1
5	MCQ	XL-U	D	1
6	MCQ	XL-U	D	1
7	NAT	XL-U	1.55 to 1.65	1
8	NAT	XL-U	103.0 to 103.2	1
9	NAT	XL-U	54 to 56	1
10	NAT	XL-U	0 to 0	1

Q.No.	Type	Section	Key/Range	Marks
11	MCQ	XL-U	B	2
12	MCQ	XL-U	C	2
13	MCQ	XL-U	C	2
14	MCQ	XL-U	A	2
15	MCQ	XL-U	D	2
16	MCQ	XL-U	A	2
17	MCQ	XL-U	B	2
18	NAT	XL-U	9.8 to 10.2	2
19	NAT	XL-U	1.1 to 1.8	2
20	NAT	XL-U	10 to 10	2