J : BOTANY

Q. 1 – Q. 10 carry one mark each.

Q.1 Which of the following is most abundant in the aleurone layer of wheat seeds?

(A) Tannin (B) Starch (C) Protein (D) Lipid

Q.2 Which of the following does NOT use xylem to transport water?

(A) *Miscanthus* (B) *Marchantia* (C) *Selaginella* (D) *Magnolia*

Q.3 Which of the following is the closest ancestor of all land plants?

(A) Blue green algae
(B) Red algae
(C) *Chara*
(D) *Coleochaeteae*

Q.4 4',6 diamidino 2-phenylindole (DAPI) is a fluorescent dye used to stain the nucleus. Which of the following plant cells, when mature, cannot be stained by DAPI?

(A) Trichomes (B) Tracheids (C) Collenchyma (D) Mesophyll

Q.5 The uptake of nitrogen (N) and phosphorus (P) by plant roots often involves interaction between root and some symbiotic organisms. Which of the following associations is most commonly found for the uptake of these two nutrients?

(A) Bacteria for N, algae for P
(B) Bacteria for N, nematodes for P
(C) Nematodes for N, fungi for P
(D) Bacteria for N, mycorrhizae for P

Q.6 Which of the following summarizes the role of Casparian strip in transport of water in the root?

(A) Symplast to Apoplast
(B) Apoplast to Symplast
(C) Phloem to Xylem
(D) Xylem to Phloem

Q.7 Atropine is a drug used in the management of pesticide poisoning. Which of the following plants can serve as a commercial source of this anticholinergic drug?

(A) *Datura metel*
(B) *Medicago trancatula*
(C) *Mangifera indica*
(D) *Arachis hypogaea*

Q.8 Which of the following is **NOT** involved in plant immune response?

(A) Antimicrobial proteins
(B) Hypersensitive response
(C) Pattern recognition receptors
(D) Interleukins

Q.9 Which of the following is a neutral phenomenon?

(A) Natural selection
(B) Sexual selection
(C) Genetic drift
(D) Population bottleneck

Q.10 When a plant is infected by a pathogen at one site, the distal parts of the plant and neighboring plants develop increased resistance to subsequent pathogen attack. Which of the following molecules mediates this long-distance signal?

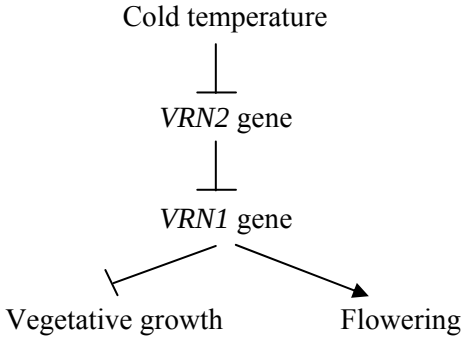
(A) Nitric oxide
(B) Ethylene
(C) Jasmonic acid and its derivatives
(D) Salicylic acid and its derivatives

Q. 11 – Q. 20 carry two marks each.

Q.11 An inbred line of a plant with red flower and tall stem was crossed to another inbred line with white flower and short stem. The F_1 plants, which all had red flower and tall stem, were backcrossed to the line with white flower and short stem, and the following F_2 individuals were obtained: 103 red, tall; 89 white, short; 26 red, short; and 23 white, tall. What is the recombination percentage between the flower color locus and the stem height locus.

(A) 19-21% (B) 49-51% (C) 79-81% (D) 0-2%

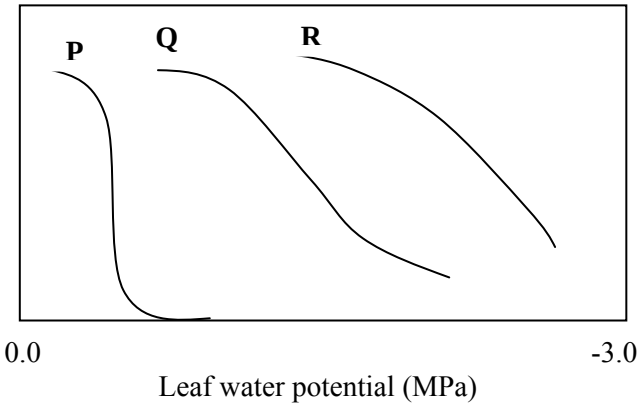
Q.12 Consider the following pathway controlling time to flowering in wheat:



If batch *P* of wheat seed is vernalized before sowing and batch *Q* is not vernalized, then which of the following statements is most likely to be correct?

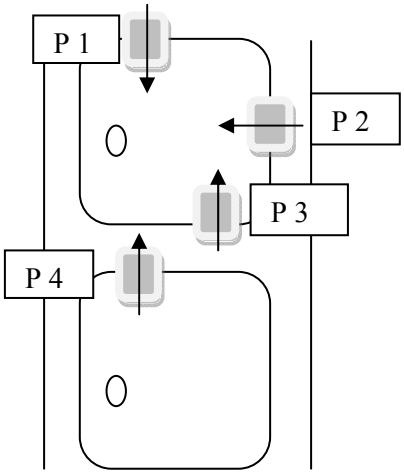
(A) *P* will have lower *VRN2* transcript and will flower later than *Q*
(B) *P* will have lower *VRN2* transcript and will flower earlier than *Q*
(C) *P* will have higher *VRN2* transcript and will flower later than *Q*
(D) *P* and *Q* will have equal *VRN2* transcript and will flower at the same time

Q.13 The three plots P, Q and R (in different units) in the graph below represent the dependence of photosynthesis rate (PR), leaf expansion rate (LER) and translocation rate of assimilates (TR) in a plant on leaf water potential. Which of the following statements is correct in this regard?



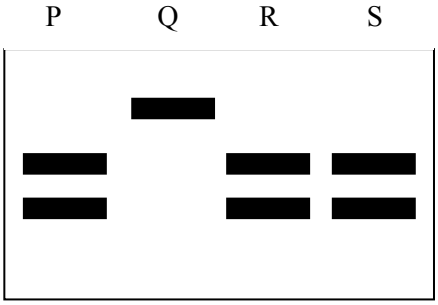
(A) P represents LER; Q represents TR; R represents PR
(B) P represents TR; Q represents PR; R represents LER
(C) P represents PR; Q represents LER; R represents TR
(D) P represents LER; Q represents PR; R represents TR

Q.14 PIN proteins are plasma membrane-localized carrier proteins required for polar auxin transport in plants. Four different carrier proteins are shown in the diagram below labeled P1-P4. Arrow indicates the direction of auxin flow. Which among these is most likely to be a PIN protein?



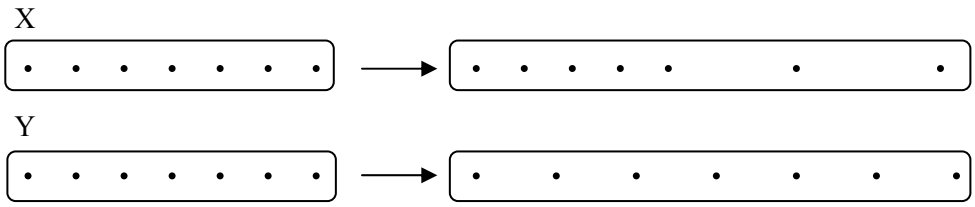
(A) P 1 (B) P 2 (C) P 3 (D) P 4

Q.15 An RFLP marker shows sequence polymorphism in two ecotypes (X and Y) of a plant. In ecotype X, the marker contains one GAATTC site in its sequence, whereas in Y it has the sequence GAAATC at the same site. The rest of the sequence is identical in both ecotypes. In a genotyping experiment, the marker was PCR amplified from four different seedlings (P, Q, R, S), completely digested with *Eco*RI and the products were analyzed by electrophoresis. The diagram below shows the band patterns obtained. Based on the information provided, which of the following statements is correct?



(A) Seedling Q belongs to ecotype Y
(B) Seedling Q belongs to ecotype X
(C) Seedling P belongs to ecotype Y
(D) Seedling R belongs to ecotype Y

Q.16 The cell surface expands differently in different plant cells. Two common modes of expansion are shown below (X and Y). Each rectangular box represents a cell marked with dots on its surface. The spacing between the dots changes after the cell has undergone expansion as indicated by the arrow. Which of the following statements is correct with respect to the growth of root hair and pollen tube?

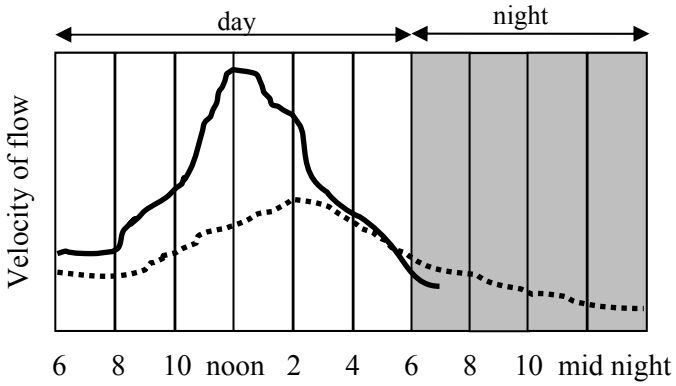


(A) Both grow as shown in X
(B) Both grow as shown in Y
(C) Pollen tube grows as shown in X, root hair grows as shown in Y
(D) Root hair grows as shown in X, pollen tube grows as shown in Y

Q.17 Hardy Weinberg's equilibrium for a locus with two alleles *p* and *q* is mathematically defined as $P^2 + Q^2 + 2PQ = 1$. Which of the following equations represents the corresponding equilibrium for a locus with three alleles *p, q* and *r*? (P, Q and R represent the frequencies of *p, q* and *r*, respectively)

(A) $P^3 + Q^3 + R^3 + 3PQR = 1$
(B) $P^2 + Q^2 + R^2 + 2PQ + 2QR + 2PR = 1$
(C) $P^2Q + Q^2R + R^2P + 2PQ + 2QR + 2PR = 1$
(D) $P^2 + Q^2 + R^2 + 2P^2Q + 2Q^2R + 2P^2R = 1$

Q.18 The continuous and dashed lines in the following graph represent the velocity of sap flow in two different parts of a plant at different times of a day. Which of the following statements is most appropriate based on this graph?



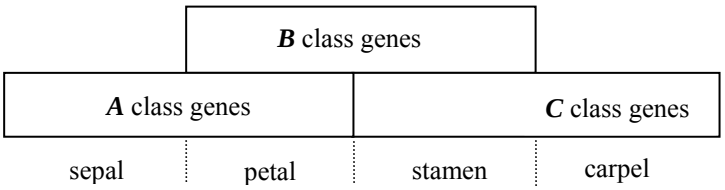
(A) The continuous line represents the trunk, and the dotted line a twig
(B) The continuous line represents a twig, and the dotted line the trunk
(C) The continuous line represents a root, and the dotted line a twig
(D) The continuous line represents a root, and the dotted line the trunk

Q.19 Given below are the names of some genes/enzymes and their use in genetically modified crops. Match the two columns.

Gene/enzyme	Commercial use
P. Bt gene	i. Golden rice
Q. β-carotene biosynthetic genes	ii. insect resistance
R. ACC deaminase	iii. herbicide resistance
S. EPSP synthase	iv. fruit ripening

(A) P, i; Q, ii; R, iii; S, iv
(B) P, ii; Q, i; R, iv; S, iii
(C) P, iii; Q, i; R, ii; S, iv
(D) P, ii; Q, i; R, iii; S, iv

Q.20 The basic tenets of the ABC model of Arabidopsis flower development are shown below along with a diagram.



i. ***A*** class genes acting alone determine sepal identity
ii. ***A*** and ***B*** class genes acting together determine petal identity
iii. ***B*** and ***C*** class genes acting together determine stamen identity
iv. ***C*** class genes acting alone determine carpel identity
v. ***A*** and ***C*** class genes mutually inhibit each other

Which of the following organ arrangements is found in an ***A*** class mutant?

(A) sepal; petal; stamen; carpel
(B) carpel; stamen; stamen; carpel
(C) petal; petal; stamen; carpel
(D) stamen; stamen; stamen; carpel

END OF THE QUESTION PAPER

Space for Rough Work

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