

# SRMJEEE Biology Sample Paper – 7

Duration: 47 Minutes

Maximum Marks: 40

## Instructions

- This paper contains **40** Multiple Choice Questions (Single Correct Answer), modelled on the Biology section of **SRMJEEE** (SRM Joint Engineering Entrance Examination).
- Each correct answer carries **+1 mark**. There is **no negative marking**; an unattempted or wrong answer scores 0.
- Only **one** option is correct. Choose carefully.
- The actual SRMJEEE is a **computer-based test** conducted in remote-proctored online mode, with all sections sharing a common time window and no per-section limit.
- Personal calculators, mobile phones, log tables and other electronic gadgets are strictly prohibited.

**Q1.** Archaeobacteria, which thrive in extreme habitats such as hot springs, salt pans and marshy soils, are classified under the kingdom:

- (A) Monera
- (B) Protista
- (C) Fungi
- (D) Plantae

**Q2.** In pteridophytes (ferns), the gametophyte that develops from a germinating spore is an independent, green, photosynthetic structure known as the:

- (A) protonema
- (B) prothallus
- (C) sporophyll



(D) rhizophore

**Q3.** An animal with a soft, unsegmented body covered by a calcareous shell, bearing a mantle and a rasping feeding organ called the radula, belongs to the phylum:

(A) Annelida

(B) Arthropoda

(C) Mollusca

(D) Porifera

**Q4.** In taxonomy, the standardised suffix used to denote the family of an *animal* (e.g. Felidae for cats) is:

(A) -aceae

(B) -ales

(C) -ophyta

(D) -idae

**Q5.** In *Acacia*, the leaf-like flattened green structure that takes over the function of photosynthesis is actually a modified petiole called a:

(A) phyllode

(B) cladode

(C) phylloclade

(D) tendril

**Q6.** *Aloe*, tulip and *Asparagus* – plants yielding medicines, ornamentals and vegetables – are members of the monocot family:

(A) Solanaceae

(B) Fabaceae

(C) Liliaceae

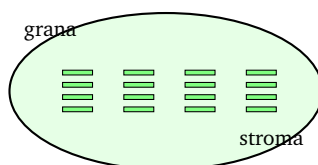
(D) Brassicaceae



**Q7.** The frog is a ureotelic vertebrate whose nitrogenous waste is removed by a pair of dark-red, flattened excretory organs of the mesonephric type, namely the:

- (A) Malpighian tubules
- (B) kidneys
- (C) nephridia
- (D) flame cells

**Q8.** The double-membraned green organelle shown below carries out photosynthesis; its disc-shaped thylakoids are stacked into grana suspended in a fluid matrix. This organelle is the:



chloroplast — grana suspended in the stroma

- (A) mitochondrion
- (B) lysosome
- (C) nucleus
- (D) chloroplast

**Q9.** The cytoplasmic ribosomes found freely in a bacterial cell differ from those of a eukaryotic cell in that the bacterial ribosomes are of the type:

- (A) 70S (with 50S and 30S subunits)
- (B) 80S (with 60S and 40S subunits)
- (C) 90S (with 60S and 30S subunits)
- (D) 55S (with 40S and 15S subunits)

**Q10.** Starch, glycogen and cellulose are all polysaccharides built from repeating units of:

- (A) amino acids
- (B) glucose monomers
- (C) fatty acids
- (D) nucleotides

**Q11.** When a diploid ( $2n$ ) cell with  $2n = 46$  chromosomes divides by mitosis, the number of chromosomes in each daughter cell produced is:

- (A) 92
- (B) 23
- (C) 46
- (D) 69

**Q12.** The random orientation and separation of maternal and paternal homologous chromosomes, which generates new chromosome combinations in the gametes, occurs during:

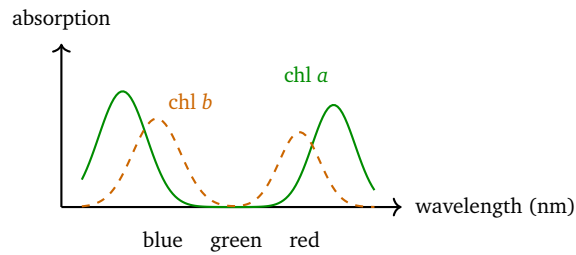
- (A) anaphase II
- (B) telophase II
- (C) prophase II
- (D) metaphase I / anaphase I of meiosis

**Q13.** The uptake of mineral ions by plant roots against a concentration gradient, requiring metabolic energy in the form of ATP, is termed:

- (A) active absorption
- (B) passive absorption
- (C) imbibition
- (D) simple diffusion

**Q14.** The graph shows the absorption spectra of two photosynthetic pigments. The pigment that absorbs strongly in the blue-violet and red regions but reflects green light, giving leaves their colour, is:





- (A) anthocyanin
- (B) chlorophyll
- (C) phytochrome
- (D) haemoglobin

**Q15.** In the link reaction connecting glycolysis to the Krebs cycle, pyruvate undergoes oxidative decarboxylation inside the mitochondrion to form:

- (A) lactic acid
- (B) oxaloacetate
- (C) acetyl-CoA
- (D) glucose-6-phosphate

**Q16.** The promotion of flowering in certain plants by a prior exposure to a period of low temperature (cold treatment) is called:

- (A) photoperiodism
- (B) phototropism
- (C) etiolation
- (D) vernalisation

**Q17.** The largest gland in the human body, which secretes bile, stores glycogen and detoxifies the blood, is the:

- (A) liver
- (B) pancreas
- (C) spleen



(D) gall bladder

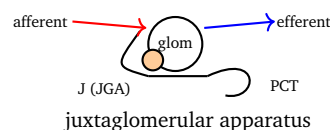
**Q18.** The red, iron-containing respiratory pigment present in human red blood cells that binds and transports oxygen is:

- (A) myoglobin
- (B) haemoglobin
- (C) haemocyanin
- (D) fibrinogen

**Q19.** In a normal electrocardiogram (ECG), the QRS complex represents the:

- (A) repolarisation of the ventricles
- (B) depolarisation (contraction) of the atria
- (C) closure of the semilunar valves
- (D) depolarisation (contraction) of the ventricles

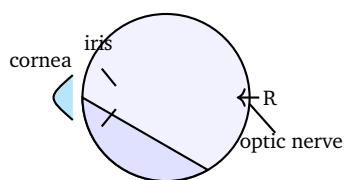
**Q20.** In the nephron region shown, a fall in glomerular blood pressure is detected by a specialised cell complex (J) that secretes the enzyme *renin*, activating the renin–angiotensin mechanism. The complex J is the:



- (A) Bowman's capsule
- (B) loop of Henle
- (C) juxtaglomerular apparatus (JGA)
- (D) collecting duct

**Q21.** In the section of the human eye shown, the light-sensitive innermost layer (R) contains the photoreceptor cells – rods and cones. This layer is the:





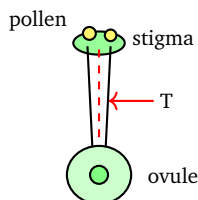
human eye (section); R = innermost layer

- (A) retina
- (B) cornea
- (C) sclera
- (D) choroid

**Q22.** The principal male sex hormone, secreted by the Leydig (interstitial) cells of the testis and responsible for the male secondary sexual characters, is:

- (A) oestrogen
- (B) testosterone
- (C) progesterone
- (D) prolactin

**Q23.** In the pistil shown, after a compatible pollen grain lands on the stigma it germinates and produces a structure (T) that grows down through the style to deliver the male gametes to the ovule. The structure T is the:



pistil; T = tube growing down the style

- (A) filament
- (B) micropyle
- (C) funicle
- (D) pollen tube



- Q24.** The significance of double fertilisation in angiosperms is that, besides forming the diploid zygote, it also gives rise to the:
- (A) seed coat from the integuments
  - (B) pericarp from the ovary wall
  - (C) triploid nutritive endosperm
  - (D) pollen tube from the pollen grain
- Q25.** In the human female, the fusion of the sperm and the secondary oocyte normally takes place in the:
- (A) ampulla of the fallopian tube
  - (B) uterine cavity
  - (C) cervix
  - (D) ovary
- Q26.** For couples who are unable to conceive naturally, the technique in which an ovum is fertilised by a sperm outside the body and the early embryo is then transferred into the uterus is the assisted reproductive technology known as:
- (A) amniocentesis
  - (B) in-vitro fertilisation (IVF / test-tube baby)
  - (C) tubectomy
  - (D) lactational amenorrhoea
- Q27.** The Punnett square shows the  $F_2$  of a dihybrid cross between round-yellow and wrinkled-green pea plants ( $RrYy \times RrYy$ ). The phenotypic ratio obtained, which illustrates Mendel's law of independent assortment, is:



	<i>RYRyrYry</i>			
<i>RY</i>	•	•	•	•
<i>Ry</i>	•	•	•	•
<i>rY</i>	•	•	•	•
<i>ry</i>	•	•	•	•

16 combinations

- (A) 3 : 1
- (B) 1 : 2 : 1
- (C) 9 : 3 : 3 : 1
- (D) 1 : 1 : 1 : 1

**Q28.** The tendency of genes located close together on the same chromosome to be inherited together, first demonstrated by T.H. Morgan in his experiments on *Drosophila*, is called:

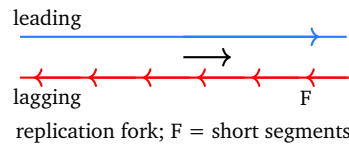
- (A) incomplete dominance
- (B) pleiotropy
- (C) polygeny
- (D) linkage

**Q29.** Phenylketonuria is an inborn error of metabolism in which the affected individual is unable to convert phenylalanine into tyrosine because of the deficiency of an:

- (A) enzyme (phenylalanine hydroxylase)
- (B) antibody
- (C) structural membrane protein
- (D) transport RNA

**Q30.** During DNA replication, the strand that is synthesised discontinuously in short segments (in the direction opposite to the movement of the replication fork) is the lagging strand. These short segments, marked F below, are called:





- (A) primers
- (B) Okazaki fragments
- (C) exons
- (D) codons

**Q31.** During protein synthesis, the type of RNA that carries a specific amino acid to the ribosome and reads the codon on the mRNA through its anti-codon is:

- (A) messenger RNA (mRNA)
- (B) ribosomal RNA (rRNA)
- (C) transfer RNA (tRNA)
- (D) heterogeneous nuclear RNA (hnRNA)

**Q32.** The preserved remains, impressions or casts of organisms of the geological past, which serve as direct palaeontological evidence for organic evolution, are called:

- (A) analogous organs
- (B) homologous organs
- (C) vestigial organs
- (D) fossils

**Q33.** Ascariasis, a disease marked by internal bleeding, muscular pain and intestinal blockage, is caused by the intestinal endoparasitic roundworm:

- (A) *Ascaris lumbricoides*
- (B) *Wuchereria bancrofti*
- (C) *Entamoeba histolytica*



(D) *Taenia solium*

**Q34.** In an allergic reaction, the class of antibody that binds to mast cells and triggers them to release histamine, producing symptoms such as sneezing and watery eyes, is:

- (A) IgG
- (B) IgE
- (C) IgM
- (D) IgA

**Q35.** *Trichoderma*, ladybird beetles and *Bacillus thuringiensis* are best described as:

- (A) chemical fertilisers
- (B) broad-spectrum herbicides
- (C) biocontrol agents of pests and pathogens
- (D) plant growth hormones

**Q36.** In recombinant DNA technology, genes such as those conferring resistance to antibiotics like ampicillin are incorporated into vectors so as to help in:

- (A) cutting the DNA at specific sites
- (B) joining the DNA fragments together
- (C) amplifying the gene of interest
- (D) identifying and selecting the transformed host cells (selectable markers)

**Q37.** The technique that allows a pathogen to be detected very early – even when present in extremely low numbers – by amplifying its nucleic acid before symptoms appear, is:

- (A) the polymerase chain reaction (PCR)

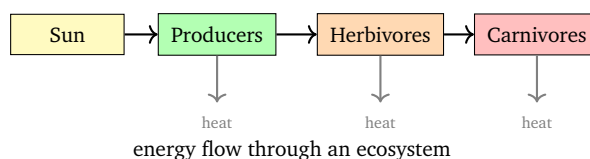


- (B) simple light microscopy of the blood
- (C) paper chromatography of serum
- (D) the tincture-iodine test

**Q38.** A cDNA (complementary DNA) library is prepared by synthesising DNA from an mRNA template using the enzyme:

- (A) DNA ligase
- (B) reverse transcriptase
- (C) restriction endonuclease
- (D) RNA polymerase

**Q39.** The diagram traces the flow of energy through the trophic levels of an ecosystem. A fundamental feature of this energy flow, in accordance with the second law of thermodynamics, is that it is:



- (A) cyclic and reversible
- (B) bidirectional
- (C) multidirectional
- (D) unidirectional (one-way)

**Q40.** Acid rain, which lowers the pH of lakes and damages buildings and forests, is produced mainly when atmospheric water reacts with the oxides of:

- (A) carbon and hydrogen
- (B) sodium and potassium
- (C) sulphur and nitrogen ( $\text{SO}_2$  and  $\text{NO}_x$ )
- (D) calcium and magnesium



## Detailed Solutions

Q1.

## Solution

**Concept — Kingdom Monera:** In the five-kingdom system, all prokaryotes – organisms whose cells lack a true (membrane-bound) nucleus and membrane-bound organelles – are placed in the kingdom Monera. This kingdom includes the eubacteria (true bacteria), cyanobacteria and the archaeobacteria.

**Key fact:** *Archaeobacteria* are the most ancient and structurally distinct prokaryotes. They survive in the harshest habitats – halophiles in extreme salt, thermoacidophiles in hot springs, and methanogens in the marshy guts of ruminants – because of their unusual branched-chain lipid cell wall. Being prokaryotic, they remain within Monera.

**Why other options are wrong:**

- (B) Protista are unicellular *eukaryotes* (e.g. *Amoeba*, *Euglena*).
- (C) Fungi and (D) Plantae are multicellular eukaryotes with a true nucleus.

**Final Answer:** Archaeobacteria are prokaryotes  $\Rightarrow$  Monera  $\Rightarrow$

**Answer:** (A) [Go Back to Q1](#)

Q2.

## Solution

**Concept — Gametophyte of pteridophytes:** Pteridophytes show a clear alternation of generations between a dominant diploid sporophyte (the fern plant) and a small but independent haploid gametophyte. The spore germinates to form this gametophytic phase.

**Key fact:** The gametophyte of a fern is a small, green, heart-shaped, free-living and *photosynthetic* structure called the *prothallus*. It bears the antheridia and archegonia and depends on moisture for fertilisation, since the flagellated sperms must swim to the egg.

**Why other options are wrong:**

- (A) The protonema is the juvenile gametophytic stage of a *moss* (bryophyte), not a fern.
- (C) A sporophyll is a sporophytic leaf bearing sporangia; (D) the rhizophore is a root-bearing branch in *Selaginella*.



**Final Answer:** Fern gametophyte = prothallus  $\Rightarrow$  **B**

**Answer: (B)** [Go Back to Q2](#)

Q3.

### Solution

**Concept — Phylum Mollusca:** Molluscs form the second-largest animal phylum. They are characterised by a soft, unsegmented body that is usually protected by a calcareous shell, a muscular foot for locomotion, and a soft fold of skin called the *mantle* that secretes the shell.

**Key fact:** The buccal cavity of most molluscs contains a *radula* – a rasping, file-like ribbon of chitinous teeth used to scrape food. Snails and *Pila* (apple snail) are familiar examples that show all of these features.

**Why other options are wrong:**

- (A) Annelida (earthworm) have a metamerically segmented body with nephridia, no radula.
- (B) Arthropoda have a jointed chitinous exoskeleton; (D) Porifera (sponges) are the simplest, pore-bearing animals with no mantle or radula.

**Final Answer:** Soft body, mantle and radula = Mollusca  $\Rightarrow$  **C**

**Answer: (C)** [Go Back to Q3](#)

Q4.

### Solution

**Concept — Standardised family suffixes:** The International Codes of Nomenclature fix uniform endings for taxonomic ranks so that the rank of a name can be read off its suffix. Plant and animal families use different conventions.

**Key fact:** The family name of an *animal* always ends in the suffix *-idae* (e.g. Felidae for the cat family, Hominidae for humans), whereas a *plant* family ends in *-aceae* (e.g. Rosaceae, Solanaceae). This single-letter cue immediately tells you whether a family is botanical or zoological.

**Why other options are wrong:**

- (A) *-aceae* is the suffix for a *plant* family, not an animal family.
- (B) *-ales* denotes a plant *order*; (C) *-ophyta* denotes a plant division/phylum.



**Final Answer:** Animal family suffix = -idae  $\Rightarrow$

**Answer:** (D) [Go Back to Q4](#)

Q5.

### Solution

**Concept — Modifications of the petiole:** In some plants the leaf lamina fails to develop or is shed, and another part of the leaf takes over photosynthesis. Such modifications reduce transpiration in dry (xerophytic) habitats.

**Key fact:** In *Acacia* (and related Australian wattles), the leaflets fall off and the *petiole* becomes flattened, green and expanded into a leaf-like *phyllode* that carries out photosynthesis. It is a true leaf modification, not a stem modification.

**Why other options are wrong:**

- (B) A cladode is a green *stem* of one or two internodes (e.g. *Asparagus*).
- (C) A phylloclade is a flattened green photosynthetic *stem* (e.g. *Opuntia*);
- (D) a tendril is a thin coiling structure for climbing.

**Final Answer:** Flattened photosynthetic petiole = phyllode  $\Rightarrow$

**Answer:** (A) [Go Back to Q5](#)

Q6.

### Solution

**Concept — Family Liliaceae:** Liliaceae is a large family of monocotyledonous plants (the “lily family”). Typical features are a herbaceous habit (often with bulbs or rhizomes), parallel-veined leaves and trimerous flowers with a perianth of six tepals.

**Key fact:** *Aloe* yields medicinal gel, tulip and *Gloriosa* are prized ornamentals, *Asparagus* is eaten as a vegetable, and *Allium* (onion, garlic) is a flavouring and source of drugs. This wide economic value is characteristic of Liliaceae.

**Why other options are wrong:**

- (A) Solanaceae (potato, tomato) is a dicot family with a bicarpellary ovary.
- (B) Fabaceae bear papilionaceous flowers and pods; (D) Brassicaceae (mustard) have cruciform flowers.

**Final Answer:** *Aloe*, tulip, *Asparagus* = Liliaceae  $\Rightarrow$



Answer: (C) [Go Back to Q6](#)

Q7.

### Solution

**Concept — Excretion in the frog:** The frog is a ureotelic animal, meaning its chief nitrogenous waste is urea. Excretion, osmoregulation and the removal of excess water are carried out by a pair of compact excretory organs.

**Key fact:** The frog has a pair of dark-red, flattened *kidneys* of the *mesonephric* type, lying against the dorsal body wall. Each kidney is made of nephrons (uriniferous tubules) that filter the blood; the urine passes through ureters to the cloaca and urinary bladder.

**Why other options are wrong:**

- (A) Malpighian tubules are the excretory organs of insects (e.g. cockroach).
- (C) Nephridia occur in annelids (earthworm); (D) flame cells (protonephridia) occur in flatworms.

**Final Answer:** Frog excretes via mesonephric kidneys ⇒ **B**

Answer: (B) [Go Back to Q7](#)

Q8.

### Solution

**Concept — The chloroplast:** The chloroplast is the green, double-membraned organelle in which photosynthesis takes place. Its internal flattened membranous sacs, the *thylakoids*, are stacked into piles called *grana*, which lie suspended in a colourless ground substance, the *stroma*.

**Key fact:** The light reactions (capture of light, photolysis of water, production of ATP and NADPH) occur on the thylakoid (grana) membranes, while the light-independent Calvin cycle (CO<sub>2</sub> fixation) occurs in the stroma. The green pigment chlorophyll and the grana–stroma layout shown in the figure are unique to the chloroplast.

**Why other options are wrong:**

- (A) The mitochondrion is double-membraned but its inner membrane forms cristae (not grana) and it is not green.
- (B) A lysosome is a single-membraned sac of digestive enzymes; (C) the nucleus holds the chromatin, not thylakoids.



**Final Answer:** Green organelle with grana and stroma = chloroplast  $\Rightarrow$

**Answer:** (D) [Go Back to Q8](#)

Q9.

### Solution

**Concept — Ribosomes:** Ribosomes are the granular sites of protein synthesis. Their size is measured by the sedimentation coefficient (S, the Svedberg unit), and this differs between prokaryotic and eukaryotic cells.

**Key fact:** Prokaryotes (and the mitochondria/chloroplasts of eukaryotes) have the smaller 70S ribosome, built from a 50S large subunit and a 30S small subunit. Eukaryotic cytoplasmic ribosomes are the larger 80S type (60S + 40S). The 70S type is the target of many antibiotics (e.g. streptomycin), which is why they harm bacteria but not the host's 80S ribosomes.

**Why other options are wrong:**

- (B) 80S (60S + 40S) is the *eukaryotic* cytoplasmic ribosome.
- (C),(D) 90S and 55S with those subunit values are not standard ribosome types.

**Final Answer:** Bacterial ribosome = 70S  $\Rightarrow$

**Answer:** (A) [Go Back to Q9](#)

Q10.

### Solution

**Concept — Polysaccharides:** Polysaccharides are large carbohydrate polymers formed by the condensation of many monosaccharide (simple sugar) units joined by glycosidic bonds. They serve either as energy stores or as structural materials.

**Key fact:** Starch (the storage carbohydrate of plants), glycogen (the storage carbohydrate of animals and fungi) and cellulose (the structural carbohydrate of plant cell walls) are all polymers of *glucose*. They differ only in their type of glycosidic linkage and branching, which is why some store energy while cellulose gives mechanical strength.

**Why other options are wrong:**

- (A) Amino acids are the monomers of proteins, not polysaccharides.
- (C) Fatty acids build fats/lipids; (D) nucleotides build nucleic acids (DNA,



RNA).

**Final Answer:** Starch, glycogen and cellulose are polymers of glucose  $\Rightarrow$  **B**

**Answer: (B)** [Go Back to Q10](#)

Q11.

### Solution

**Concept — Mitosis is equational:** Mitosis is the division of a somatic cell that produces two genetically identical daughter cells. Because the replicated sister chromatids of each chromosome are distributed equally, the chromosome number is conserved.

**Key fact:** In mitosis the parent cell's chromosomes are first duplicated (S-phase) and then split exactly at anaphase, so each daughter receives the *same* diploid number as the parent. Starting from  $2n = 46$ , each daughter cell also has 46 chromosomes. This constancy is essential for growth and tissue repair.

**Why other options are wrong:**

- (A) 92 would result only if chromatids failed to separate (endoreduplication), not normal mitosis.
- (B) 23 (halving) is the outcome of *meiosis*; (D) 69 is triploid and abnormal.

**Final Answer:** Mitosis keeps the number constant = 46  $\Rightarrow$  **C**

**Answer: (C)** [Go Back to Q11](#)

Q12.

### Solution

**Concept — Independent assortment in meiosis:** Meiosis I separates the homologous chromosomes of each pair. A key source of genetic variation is the way the two members of each homologous pair line up and then move at random with respect to the other pairs.

**Key fact:** At *metaphase I* the bivalents align at the equator, and at *anaphase I* the maternal and paternal homologues of each pair separate independently of all other pairs. This random distribution – the cytological basis of Mendel's law of *independent assortment* – produces  $2^n$  possible chromosome combinations in the gametes.

**Why other options are wrong:**



- (A) Anaphase II separates sister *chromatids*, not homologues.
- (B),(C) Telophase II and prophase II occur after the homologues have already assorted in meiosis I.

**Final Answer:** Independent assortment of homologues = metaphase/anaphase I

⇒  D

Answer: (D) [Go Back to Q12](#)

Q13.

### Solution

**Concept — Mineral ion uptake by roots:** Roots absorb mineral ions from the soil solution by two broad mechanisms – a passive (non-metabolic) phase and an active (metabolic) phase – depending on whether energy is needed.

**Key fact:** *Active absorption* moves ions *against* their electrochemical (concentration) gradient using carrier proteins and direct expenditure of *ATP*. It is sensitive to respiratory inhibitors and oxygen supply, since the energy comes from root respiration. Passive absorption, in contrast, follows the gradient and needs no metabolic energy.

**Why other options are wrong:**

- (B) Passive absorption moves ions *down* the gradient without *ATP*.
- (C) Imbibition is the swelling of hydrophilic solids by water; (D) simple diffusion is a passive, energy-free spreading of particles.

**Final Answer:** Energy-dependent uptake against the gradient = active absorption

⇒  A

Answer: (A) [Go Back to Q13](#)

Q14.

### Solution

**Concept — Photosynthetic pigments and the absorption spectrum:** A plot of how much light a pigment absorbs at each wavelength is its absorption spectrum. The major light-harvesting pigments of green plants are the chlorophylls (a and b).

**Key fact:** *Chlorophyll* absorbs strongly in the blue-violet (around 430–450 nm) and red (around 640–680 nm) regions but *reflects/transmits green* light, which is



why leaves look green. Chlorophyll a is the primary pigment (reaction centre), while chlorophyll b is an accessory pigment whose peaks are shifted, as the two curves in the figure show.

**Why other options are wrong:**

- (A) Anthocyanin is a water-soluble vacuolar pigment (reds/blues), not the main photosynthetic pigment.
- (C) Phytochrome is a photoreceptor pigment for photoperiodism, not bulk light harvesting; (D) haemoglobin is an animal respiratory pigment.

**Final Answer:** Pigment absorbing blue and red, reflecting green = chlorophyll  $\Rightarrow$

**B**

**Answer: (B)** [Go Back to Q14](#)

Q15.

### Solution

**Concept — The link (transition) reaction:** Glycolysis ends in the cytoplasm with pyruvate. Before the Krebs cycle can begin, pyruvate must enter the mitochondrial matrix and be converted into the cycle's starting material – this bridging step is the link reaction.

**Key fact:** In the link reaction, the 3-carbon *pyruvate* undergoes *oxidative decarboxylation* by the pyruvate dehydrogenase complex: it loses a  $\text{CO}_2$ , is oxidised (forming NADH), and the remaining 2-carbon acetyl group is attached to coenzyme A to give *acetyl-CoA*. Acetyl-CoA then combines with oxaloacetate to enter the Krebs cycle.

**Why other options are wrong:**

- (A) Lactic acid forms only in anaerobic fermentation, not the aerobic link reaction.
- (B) Oxaloacetate is the acceptor that acetyl-CoA combines *with*; (D) glucose-6-phosphate is an early glycolytic intermediate.

**Final Answer:** Pyruvate  $\rightarrow$  acetyl-CoA  $\Rightarrow$  **C**

**Answer: (C)** [Go Back to Q15](#)



Q16.

**Solution**

**Concept — Vernalisation:** Some plants, especially biennials and winter varieties of cereals, will not flower unless they first experience a spell of cold. This qualitative dependence of flowering on low temperature is a distinct developmental phenomenon.

**Key fact:** *Vernalisation* is the promotion of flowering by a prior exposure to *low temperature*. For example, winter wheat sown in spring stays vegetative unless its germinating seeds are chilled, after which it flowers normally. It ensures that the plant flowers only in a favourable season.

**Why other options are wrong:**

- (A) Photoperiodism is the response of flowering to the relative lengths of day and night, not to cold.
- (B) Phototropism is bending towards light; (C) etiolation is the pale, spindly growth of plants in darkness.

**Final Answer:** Cold-induced promotion of flowering = vernalisation  $\Rightarrow$

[Go Back to Q16](#)

Q17.

**Solution**

**Concept — Functions of the liver:** The liver is the largest gland of the body and a major metabolic hub. It plays roles in digestion, in the storage and interconversion of nutrients, and in detoxification.

**Key fact:** The *liver* secretes *bile* (which emulsifies fats and aids their digestion), stores excess glucose as *glycogen* and releases it when needed (regulating blood sugar), deaminates amino acids and converts the toxic ammonia into urea, and detoxifies drugs, alcohol and other poisons. These combined roles make it indispensable.

**Why other options are wrong:**

- (B) The pancreas secretes digestive enzymes and the hormones insulin/glucagon, but does not make bile.
- (C) The spleen is a lymphoid organ that filters blood; (D) the gall bladder only *stores* bile made by the liver.

**Final Answer:** Largest gland; bile, glycogen, detoxification = liver  $\Rightarrow$



Answer: (A) [Go Back to Q17](#)

Q18.

### Solution

**Concept — Respiratory pigments:** Animals use coloured metal-containing proteins to carry oxygen efficiently, because oxygen alone dissolves poorly in plasma. In humans this pigment is packed inside the red blood cells.

**Key fact:** *Haemoglobin* is the red, iron-containing respiratory pigment of the RBCs. Each molecule has four haem groups, and each  $\text{Fe}^{2+}$  ion binds one  $\text{O}_2$ , so one haemoglobin carries four oxygen molecules. It loads  $\text{O}_2$  in the lungs and unloads it in the tissues, and also helps carry  $\text{CO}_2$  back.

**Why other options are wrong:**

- (A) Myoglobin stores oxygen in *muscle*, but does not transport it in the blood.
- (C) Haemocyanin is the blue, *copper*-based pigment of molluscs and arthropods; (D) fibrinogen is a clotting protein, not an oxygen carrier.

**Final Answer:** Oxygen-carrying pigment of RBCs = haemoglobin  $\Rightarrow$  **B**

Answer: (B) [Go Back to Q18](#)

Q19.

### Solution

**Concept — The electrocardiogram (ECG):** An ECG is a recording of the electrical activity of the heart during one cardiac cycle. It shows a characteristic series of deflections – the P wave, the QRS complex and the T wave – each linked to a specific event.

**Key fact:** The *QRS complex* represents the *depolarisation of the ventricles*, which immediately triggers their contraction (systole). It is the tallest deflection because the ventricular muscle mass is large. (The P wave marks atrial depolarisation and the T wave marks ventricular repolarisation.)

**Why other options are wrong:**

- (A) Ventricular repolarisation is shown by the *T* wave, not the QRS.
- (B) Atrial depolarisation is the *P* wave; (C) valve closure produces heart *sounds*, not an ECG wave.

**Final Answer:** QRS complex = ventricular depolarisation  $\Rightarrow$  **D**



Answer: (D) [Go Back to Q19](#)

Q20.

### Solution

**Concept — The juxtaglomerular apparatus (JGA):** Where the distal convoluted tubule loops back to touch the afferent arteriole of its own glomerulus, a specialised cluster of cells forms a sensor-and-secretor unit that regulates blood pressure and filtration.

**Key fact:** The *juxtaglomerular apparatus* contains modified smooth-muscle cells in the afferent arteriole. When glomerular blood flow or pressure falls (or  $\text{Na}^+$  drops), the JGA secretes the enzyme *renin*. Renin converts angiotensinogen to angiotensin I, which becomes angiotensin II – a vasoconstrictor that also stimulates aldosterone, restoring blood pressure and the glomerular filtration rate. This is the renin–angiotensin mechanism.

**Why other options are wrong:**

- (A) Bowman’s capsule merely cups the glomerulus and collects the filtrate.
- (B) The loop of Henle concentrates the filtrate; (D) the collecting duct fine-tunes water reabsorption under ADH.

**Final Answer:** Renin-secreting complex = JGA  $\Rightarrow$

Answer: (C) [Go Back to Q20](#)

Q21.

### Solution

**Concept — Layers of the eyeball:** The wall of the human eyeball has three coats – an outer fibrous sclera (with the transparent cornea), a middle vascular choroid (with iris and ciliary body), and an inner sensory layer where light is actually detected.

**Key fact:** The innermost layer is the *retina*, which carries the photoreceptor cells: the *rods* (sensitive in dim light, giving black-and-white vision) and the *cones* (working in bright light, giving colour vision and sharp images at the fovea). Light focused by the lens forms an image on the retina, and the photoreceptors convert it into nerve impulses that travel down the optic nerve.

**Why other options are wrong:**

- (B) The cornea is the transparent front window that refracts light; it has no



photoreceptors.

- (C) The sclera is the tough white protective coat; (D) the choroid supplies blood and absorbs stray light.

**Final Answer:** Layer with rods and cones = retina ⇒

**Answer: (A)** [Go Back to Q21](#)

Q22.

### Solution

**Concept — Gonadal (sex) hormones:** The gonads are both gamete-producing and endocrine organs. The testis secretes androgens and the ovary secretes oestrogens and progesterone, which control the secondary sexual characters.

**Key fact:** *Testosterone*, the chief androgen, is secreted by the *Leydig (interstitial) cells* of the testis under the control of LH. It drives spermatogenesis and the male secondary sexual characters – deep voice, facial and body hair, and muscular build. (Oestrogen, from the ovarian follicle, plays the analogous role in the female.)

**Why other options are wrong:**

- (A) Oestrogen is the principal *female* sex hormone from the ovary.
- (C) Progesterone maintains the uterine lining/pregnancy; (D) prolactin from the pituitary stimulates milk production.

**Final Answer:** Male sex hormone from the testis = testosterone ⇒

**Answer: (B)** [Go Back to Q22](#)

Q23.

### Solution

**Concept — Pollen-pistil interaction:** After pollination, the pistil chemically recognises whether the pollen is compatible. A compatible grain then germinates on the stigma and grows towards the ovule, carrying the male gametes to the egg.

**Key fact:** The germinating pollen grain puts out a *pollen tube* that emerges through a germ pore and grows down the style, guided chemically, until it reaches the ovule and enters it (usually through the micropyle). The tube carries the two male gametes to the embryo sac for double fertilisation.

**Why other options are wrong:**



- (A) The filament is the stalk of the stamen that bears the anther; it has no role in delivering gametes.
- (B) The micropyle is the *opening* of the ovule the tube enters; (C) the funicle is the stalk attaching the ovule to the placenta.

**Final Answer:** Structure carrying male gametes down the style = pollen tube  $\Rightarrow$

D

**Answer: (D)** [Go Back to Q23](#)

Q24.

### Solution

**Concept — Significance of double fertilisation:** Double fertilisation is a feature unique to angiosperms in which *two* fusion events occur inside the embryo sac, using both male gametes delivered by the pollen tube.

**Key fact:** One male gamete fuses with the egg (syngamy) to form the diploid zygote, while the second fuses with the two polar nuclei (triple fusion) to form the *triploid (3n) primary endosperm nucleus*, which develops into the *endosperm*. The significance is that the nutritive endosperm is formed only *after* a successful fertilisation, so no food reserve is wasted on an unfertilised ovule.

**Why other options are wrong:**

- (A) The seed coat develops from the integuments, independently of the fusion events.
- (B) The pericarp forms from the ovary wall, not from a fertilisation product;
- (D) the pollen tube is formed before fertilisation, not by it.

**Final Answer:** Double fertilisation also yields the triploid endosperm  $\Rightarrow$  C

**Answer: (C)** [Go Back to Q24](#)

Q25.

### Solution

**Concept — Site of human fertilisation:** After ovulation the secondary oocyte is swept into the fallopian tube (oviduct), and sperms deposited in the vagina swim up through the uterus into the tube. Fertilisation occurs where the two gametes meet.

**Key fact:** Fertilisation normally takes place in the *ampulla* – the wide, upper one-



third region of the *fallopian tube* (oviduct). It is here that a sperm penetrates the oocyte, triggering the completion of meiosis II and the formation of the diploid zygote, which then moves to the uterus for implantation.

**Why other options are wrong:**

- (B) The uterus is the site of *implantation* and development, not fertilisation.
- (C) The cervix is the neck of the uterus, only a passage; (D) the ovary merely releases the oocyte at ovulation.

**Final Answer:** Fertilisation occurs in the ampulla of the oviduct ⇒ A

Answer: (A) [Go Back to Q25](#)

Q26.

### Solution

**Concept — Infertility and assisted reproductive technologies (ART):** When a couple cannot conceive even after regular unprotected intercourse, the cause may lie with either partner. ART comprises special techniques that help such couples to have a child.

**Key fact:** In *in-vitro fertilisation* (IVF), popularly the “test-tube baby” technique, ova and sperms are collected and made to fuse *outside* the body under laboratory conditions. The resulting early embryo (zygote or up to the 8-blastomere stage by ZIFT, or beyond by IUT) is then transferred into the woman’s fallopian tube or uterus to continue development.

**Why other options are wrong:**

- (A) Amniocentesis is a prenatal *diagnostic* test, not a fertility treatment.
- (C) Tubectomy is a *contraceptive* sterilisation method; (D) lactational amenorrhoea is a natural method of contraception.

**Final Answer:** Fertilisation outside the body, embryo transferred = IVF ⇒ B

Answer: (B) [Go Back to Q26](#)



Q27.

**Solution**

**Concept — Dihybrid cross and independent assortment:** Mendel's law of independent assortment states that the alleles of two different genes are distributed to the gametes independently of one another. A dihybrid cross tests this with two characters at once.

**Step 1 — Gametes:** Each  $RrYy$  parent makes four kinds of gametes –  $RY$ ,  $Ry$ ,  $rY$ ,  $ry$  – in equal numbers.

**Step 2 — The grid:** The  $4 \times 4$  Punnett square gives 16 combinations. Counting phenotypes: 9 round-yellow, 3 round-green, 3 wrinkled-yellow, 1 wrinkled-green.

**Step 3 — Ratio:** The  $F_2$  phenotypic ratio is  $9 : 3 : 3 : 1$ , the hallmark of independent assortment.

**Why other options are wrong:**

- (A)  $3 : 1$  is the *monohybrid*  $F_2$  ratio (one gene).
- (B)  $1 : 2 : 1$  is a monohybrid *genotypic* ratio; (D)  $1 : 1 : 1 : 1$  is the dihybrid *test-cross* ratio.

**Final Answer:** Dihybrid  $F_2$  ratio =  $9 : 3 : 3 : 1 \Rightarrow$   C

**Answer:** (C) [Go Back to Q27](#)

Q28.

**Solution**

**Concept — Linkage and recombination:** Genes that lie on the *same* chromosome do not assort independently; they tend to travel together into the gametes. T.H. Morgan studied this using the fruit fly *Drosophila melanogaster*.

**Key fact:** *Linkage* is the physical association of genes on a chromosome, causing them to be inherited together and giving a lower-than-expected proportion of recombinant types. Morgan found that the closer two genes lie, the stronger their linkage; crossing over between them produces recombination, and the recombination frequency is used to map gene positions on the chromosome.

**Why other options are wrong:**

- (A) Incomplete dominance is a blending of two alleles of *one* gene.
- (B) Pleiotropy is one gene affecting many traits; (C) polygeny is many genes affecting one trait.



**Final Answer:** Genes on the same chromosome inherited together = linkage  $\Rightarrow$   D

**Answer: (D)** [Go Back to Q28](#)

Q29.

### Solution

**Concept — Inborn errors of metabolism:** These are inherited disorders in which a mutated gene fails to make a functional enzyme, so a particular metabolic step is blocked and substrates accumulate. Phenylketonuria (PKU) is the classic example.

**Key fact:** In PKU the individual lacks the *enzyme phenylalanine hydroxylase*, so phenylalanine cannot be converted into tyrosine. The phenylalanine accumulates and is diverted into phenylpyruvic acid and other derivatives, which are excreted in the urine and, if untreated, damage the developing brain causing intellectual disability. It is inherited as an autosomal recessive trait.

**Why other options are wrong:**

- (B) An antibody deficiency causes immune problems, not PKU.
- (C) A structural membrane protein defect is unrelated to phenylalanine metabolism; (D) tRNA carries amino acids in translation, not this conversion.

**Final Answer:** PKU is due to deficiency of an enzyme  $\Rightarrow$   A

**Answer: (A)** [Go Back to Q29](#)

Q30.

### Solution

**Concept — Semi-discontinuous DNA replication:** DNA polymerase can add nucleotides only in the  $5' \rightarrow 3'$  direction. Because the two parental strands are antiparallel, only one new strand can be made continuously towards the fork; the other must be made in pieces.

**Key fact:** On the *lagging strand*, synthesis proceeds away from the replication fork in short stretches called *Okazaki fragments*. Each fragment is started by an RNA primer; the fragments are later joined into a continuous strand by *DNA ligase*. This piecemeal copying is why replication is described as semi-discontinuous.

**Why other options are wrong:**



- (A) Primers are the short RNA starters *on which* Okazaki fragments are built, not the fragments themselves.
- (C) Exons are coding regions of a gene; (D) codons are triplets of mRNA bases read during translation.

**Final Answer:** Short pieces on the lagging strand = Okazaki fragments ⇒

[Go Back to Q30](#)

Q31.

### Solution

**Concept — Types of RNA:** Three main classes of RNA cooperate in gene expression: messenger RNA (mRNA) carries the genetic message, ribosomal RNA (rRNA) builds the ribosome, and transfer RNA (tRNA) supplies the amino acids.

**Key fact:** *Transfer RNA (tRNA)* is a small clover-leaf-shaped adaptor molecule. One end carries a specific amino acid, while a three-base *anticodon* loop pairs with the complementary *codon* on the mRNA at the ribosome. In this way tRNA translates the nucleotide sequence into the correct amino acid sequence of the protein.

**Why other options are wrong:**

- (A) mRNA *carries* the codons but does not transport amino acids.
- (B) rRNA forms the structural and catalytic core of the ribosome; (D) hnRNA is the unprocessed primary transcript in the nucleus.

**Final Answer:** Amino-acid-carrying, anticodon-bearing RNA = tRNA ⇒

[Go Back to Q31](#)

Q32.

### Solution

**Concept — Evidences for evolution:** Several independent lines of evidence support organic evolution – comparative anatomy (homologous and analogous organs), embryology, molecular biology and, most directly, the fossil record.

**Key fact:** *Fossils* are the preserved remains, impressions, casts or moulds of past organisms, usually found in sedimentary rocks and dated by their position in the strata. Palaeontological study of fossils shows a sequence of forms in time, reveals transitional/connecting forms (e.g. *Archaeopteryx* linking reptiles and birds) and provides the most direct evidence that life has changed over geological time.



**Why other options are wrong:**

- (A) Analogous organs (e.g. wings of insect and bird) illustrate convergent evolution, not the fossil record.
- (B) Homologous organs show divergent evolution; (C) vestigial organs are reduced remnants – both are anatomical, not palaeontological, evidence.

**Final Answer:** Palaeontological (direct) evidence = fossils ⇒

[Go Back to Q32](#)

**Q33.****Solution**

**Concept — Helminth (roundworm) diseases:** Several human diseases are caused by parasitic worms. Ascariasis is one of the commonest intestinal infections, spread through food and water contaminated with the parasite's eggs.

**Key fact:** Ascariasis is caused by the roundworm *Ascaris lumbricoides*, the common intestinal roundworm of humans. Ingested eggs hatch in the intestine; the larvae migrate through the liver and lungs before maturing in the intestine, producing internal bleeding, muscular pain, fever, anaemia and blockage of the intestinal passage.

**Why other options are wrong:**

- (B) *Wuchereria bancrofti* causes filariasis (elephantiasis), spread by *Culex* mosquitoes.
- (C) *Entamoeba histolytica* causes amoebiasis (a protozoan); (D) *Taenia solium* is the pork tapeworm, a flatworm.

**Final Answer:** Ascariasis is caused by *Ascaris lumbricoides* ⇒

[Go Back to Q33](#)



Q34.

**Solution**

**Concept — Hypersensitivity (allergy):** An allergy is an exaggerated immune response to otherwise harmless substances (allergens) such as pollen, dust mites or certain foods. The reaction is mediated by a particular class of antibody.

**Key fact:** On first exposure, an allergen stimulates the production of *IgE* antibodies, which attach to the surface of mast cells and basophils. On re-exposure, the allergen cross-links these *IgE* molecules, triggering the cells to release *histamine* and serotonin. These mediators cause the typical symptoms – sneezing, watery eyes, a runny nose, itching and, in severe cases, anaphylaxis.

**Why other options are wrong:**

- (A) *IgG* is the most abundant antibody in secondary immune responses, not the allergy mediator.
- (C) *IgM* is the first antibody made in a primary response; (D) *IgA* guards mucosal surfaces and milk.

**Final Answer:** Allergy is mediated by *IgE* (histamine release) ⇒ **B**

**Answer: (B)** [Go Back to Q34](#)

Q35.

**Solution**

**Concept — Biological control of pests:** Biocontrol uses living organisms – predators, parasites or pathogens – to keep the populations of crop pests and disease-causing organisms in check, reducing reliance on toxic chemical pesticides.

**Key fact:** *Bacillus thuringiensis* is a bacterium whose Cry toxin kills caterpillars and other insect larvae; the *ladybird* beetle preys on aphids and other soft-bodied pests; and *Trichoderma* is a free-living fungus that controls several plant-pathogenic fungi. All three are therefore *biocontrol agents*, environmentally safer than broad-spectrum chemicals.

**Why other options are wrong:**

- (A) Chemical fertilisers supply nutrients; they do not control pests.
- (B) Herbicides kill weeds chemically (not living agents); (D) plant growth hormones regulate development.

**Final Answer:** *Bt*, ladybird and *Trichoderma* = biocontrol agents ⇒ **C**



Answer: (C) [Go Back to Q35](#)

Q36.

### Solution

**Concept — Selectable markers:** When a recombinant DNA molecule is introduced into host cells, only a few cells actually take it up. A way is needed to pick out (select) these transformed cells from the vast majority of untransformed ones.

**Key fact:** A *selectable marker* is a gene on the vector – typically conferring resistance to an *antibiotic* such as ampicillin, tetracycline or kanamycin – that helps in *identifying and eliminating non-transformants, thereby selecting the transformed host cells*. Only cells carrying the vector (and its marker) survive on a medium containing the antibiotic, so they can be selected.

**Why other options are wrong:**

- (A) Cutting DNA at specific sites is done by restriction endonucleases.
- (B) Joining DNA fragments is the job of DNA ligase; (C) amplifying the gene is done by PCR.

**Final Answer:** Antibiotic-resistance genes act as selectable markers ⇒

Answer: (D) [Go Back to Q36](#)

Q37.

### Solution

**Concept — Molecular diagnosis of disease:** Conventional methods (such as microscopy or serum tests) detect a pathogen only after its numbers have built up and symptoms have appeared. Molecular techniques detect the pathogen's nucleic acid far earlier and far more sensitively.

**Key fact:** The *polymerase chain reaction (PCR)* amplifies even a few copies of a pathogen's DNA (or its cDNA) into millions of copies *in vitro*, so the infection can be diagnosed when the organism is still present in very low numbers, before symptoms develop. Used with specific *probes*, PCR is now routine for detecting HIV, the SARS-CoV-2 virus and many genetic disorders.

**Why other options are wrong:**

- (B) Ordinary light microscopy detects a pathogen only once it is fairly abundant – too late for very early diagnosis.



- (C) Paper chromatography separates small molecules, not pathogen nucleic acids; (D) the tincture-iodine test is an antiseptic/starch test, not a diagnostic for pathogens.

**Final Answer:** Early, low-number detection by amplifying nucleic acid = PCR ⇒

A

**Answer: (A)** [Go Back to Q37](#)

Q38.

### Solution

**Concept — cDNA and the cDNA library:** A cDNA (complementary DNA) library is a collection of DNA copies made from the mRNA population of a cell. Because it is built from mature mRNA, it contains only the expressed, intron-free coding sequences.

**Key fact:** cDNA is synthesised from an mRNA template by the enzyme *reverse transcriptase* (an RNA-dependent DNA polymerase, originally obtained from retroviruses). It makes a single DNA strand complementary to the mRNA, which is then converted to double-stranded cDNA and cloned. Since introns have already been spliced out of the mRNA, the cDNA can be expressed directly in a bacterial host.

**Why other options are wrong:**

- (A) DNA ligase only *joins* DNA fragments; it does not copy RNA into DNA.
- (C) A restriction endonuclease cuts DNA; (D) RNA polymerase makes RNA from DNA, the reverse of what is needed here.

**Final Answer:** cDNA is made from mRNA by reverse transcriptase ⇒ B

**Answer: (B)** [Go Back to Q38](#)

Q39.

### Solution

**Concept — Energy flow in an ecosystem:** Energy enters an ecosystem as sunlight, is fixed by producers, and passes step by step to herbivores, carnivores and so on along the food chain. The way this energy moves obeys the laws of thermodynamics.

**Key fact:** The flow of energy through an ecosystem is *unidirectional* – it moves one way, from the sun to producers to successive consumers, and is never recycled



back. At each transfer a large part of the energy is lost as heat (the 10% law), in accordance with the second law of thermodynamics, so the energy available decreases at every higher trophic level. (Nutrients, by contrast, are cycled.)

**Why other options are wrong:**

- (A) Energy flow is not cyclic; the lost heat cannot be reused by the ecosystem.
- (B),(C) It is neither bidirectional nor multidirectional – it follows a single direction along the trophic levels.

**Final Answer:** Energy flow through an ecosystem is unidirectional ⇒  D

**Answer:** (D) [Go Back to Q39](#)

Q40.

### Solution

**Concept — Acid rain:** Burning of fossil fuels in vehicles, power stations and industries releases gaseous oxides into the air. These oxides react with atmospheric moisture to form acids that come down with the rain.

**Key fact:** *Sulphur dioxide* ( $\text{SO}_2$ ) and the *oxides of nitrogen* ( $\text{NO}_x$ ) dissolve in rain-water to produce sulphuric acid and nitric acid, lowering the pH of the rain to below 5.6 (acid rain). Its effects include acidified lakes and rivers (killing fish), damaged forests and soils, and the corrosion of buildings and monuments such as the marble of the Taj Mahal.

**Why other options are wrong:**

- (A) The oxides of carbon ( $\text{CO}_2$ ) cause global warming, not the strong acidity of acid rain.
- (B),(D) Oxides of sodium, potassium, calcium and magnesium are basic/neutral and do not produce acid rain.

**Final Answer:** Acid rain is caused by oxides of sulphur and nitrogen ⇒  C

**Answer:** (C) [Go Back to Q40](#)



## Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	C	4	D	5	A
6	C	7	B	8	D	9	A	10	B
11	C	12	D	13	A	14	B	15	C
16	D	17	A	18	B	19	D	20	C
21	A	22	B	23	D	24	C	25	A
26	B	27	C	28	D	29	A	30	B
31	C	32	D	33	A	34	B	35	C
36	D	37	A	38	B	39	D	40	C

