

SRMJEEE Biology Sample Paper – 2

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. Organisms that are eukaryotic, mostly multicellular, and heterotrophic — obtaining nourishment by *absorption* after secreting digestive enzymes onto their food — are placed in the kingdom:

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

Q2. Bryophytes are called the “amphibians of the plant kingdom” chiefly because they:

- (A) can live equally well in salt water and fresh water
- (B) have both gills and lungs at different life stages
- (C) live on land but require water for fertilisation (flagellated sperms swim to the egg)



(D) are the ancestors of modern amphibian animals

Q3. The presence of stinging cells called *cnidoblasts* (containing nematocysts) used for capturing prey and defence is the defining feature of the phylum to which *Hydra* belongs, namely:

- (A) Porifera
- (B) Cnidaria (Coelenterata)
- (C) Platyhelminthes
- (D) Annelida

Q4. Which of the following correctly arranges the major taxonomic categories in descending order (from the largest, most inclusive to the smallest)?

- (A) Species > Genus > Family > Order > Class > Phylum > Kingdom
- (B) Kingdom > Class > Phylum > Family > Order > Genus > Species
- (C) Kingdom > Order > Phylum > Class > Family > Genus > Species
- (D) Kingdom > Phylum > Class > Order > Family > Genus > Species

Q5. Ginger and turmeric are obtained from a horizontally growing underground stem that bears nodes, scale leaves and axillary buds. This stem modification is a:

- (A) rhizome
- (B) stem tuber
- (C) corm
- (D) taproot

Q6. Actinomorphic flowers, a bicarpellary syncarpous ovary with axile placentation, and a fruit that is a berry or capsule are characteristic floral features of the plant family (e.g. potato, tomato):

- (A) Fabaceae

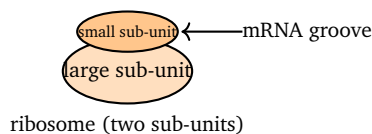


- (B) Liliaceae
- (C) Solanaceae
- (D) Poaceae

Q7. The circulatory system of the cockroach is described as an *open* system because:

- (A) the blood (haemolymph) is bright red and carries oxygen
- (B) the colourless haemolymph flows freely through body spaces (sinuses) and is not always confined to vessels
- (C) blood circulates only inside closed capillaries as in mammals
- (D) the heart is absent and diffusion alone moves the fluid

Q8. The organelle shown below consists of a smaller and a larger sub-unit, lacks any membrane, and is the site where amino acids are joined together to make proteins. It is the:



- (A) lysosome
- (B) centriole
- (C) peroxisome
- (D) ribosome

Q9. The cell theory, proposed by Schleiden and Schwann and later extended by Rudolf Virchow with the dictum *omnis cellula e cellula*, states that:

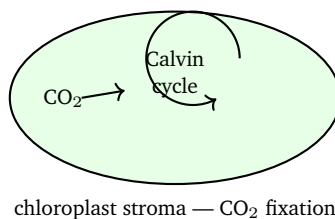
- (A) all living organisms are made of cells, and new cells arise only from the division of pre-existing cells
- (B) cells can arise spontaneously from non-living matter
- (C) only plants are made of cells, while animals are not
- (D) the cell is the largest living unit visible to the naked eye



- Q10.** The high specificity of an enzyme for its substrate is classically explained by a model in which the substrate fits precisely into the active site, like a key fitting a particular lock. This is the:
- (A) fluid-mosaic model
 - (B) lock-and-key model
 - (C) sliding-filament model
 - (D) semi-conservative model
- Q11.** During which stage of mitosis do the chromosomes become arranged along the equatorial plate (the metaphase plate) of the cell, with their centromeres attached to spindle fibres?
- (A) prophase
 - (B) anaphase
 - (C) metaphase
 - (D) telophase
- Q12.** Meiosis is called a reduction division because it:
- (A) halves the chromosome number, producing haploid (n) cells from a diploid ($2n$) cell
 - (B) doubles the chromosome number from $2n$ to $4n$
 - (C) keeps the chromosome number unchanged at $2n$
 - (D) removes the nucleus from the daughter cells
- Q13.** The appearance of water droplets at the margins of leaves of small herbaceous plants on humid mornings — a phenomenon that demonstrates *root pressure* — is called:
- (A) transpiration
 - (B) imbibition
 - (C) plasmolysis
 - (D) guttation



- Q14.** In the stroma of the chloroplast shown, the cycle that fixes CO_2 into carbohydrate during the light-independent reactions is catalysed at its first step by the enzyme:



- (A) amylase
(B) RuBisCO (ribulose biphosphate carboxylase-oxygenase)
(C) DNA polymerase
(D) pepsin
- Q15.** Glycolysis, the first stage of glucose breakdown, occurs in the cytoplasm and converts one glucose molecule into two molecules of pyruvate with a *net* gain of:
- (A) 38 ATP
(B) zero ATP
(C) 2 ATP
(D) 36 ATP
- Q16.** Which group of plant growth regulators promotes stem (internode) elongation, induces *bolting* in rosette plants, and breaks seed dormancy to aid germination?
- (A) abscisic acid
(B) ethylene
(C) cytokinins
(D) gibberellins
- Q17.** The protein-digesting enzyme that is secreted in the stomach as inactive pepsinogen and works best in a strongly acidic (low pH) medium is:



- (A) pepsin
- (B) ptyalin
- (C) trypsin
- (D) amylase

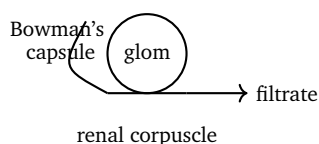
Q18. The maximum volume of air a person can breathe out after a maximum inspiration — equal to the sum of tidal volume, inspiratory reserve volume and expiratory reserve volume ($TV + IRV + ERV$) — is called the:

- (A) residual volume
- (B) tidal volume
- (C) vital capacity
- (D) dead-space volume

Q19. During the cardiac cycle, the first heart sound “lub” (*lubb*) is produced by the:

- (A) closure of the semilunar valves at the start of ventricular diastole
- (B) closure of the atrioventricular (bicuspid and tricuspid) valves at the start of ventricular systole
- (C) opening of the atrioventricular valves
- (D) contraction of the atria

Q20. In the part of the nephron shown, blood pressure forces water and small solutes out of the glomerular capillaries into the surrounding cup-shaped capsule. This pressure-driven filtration is called:

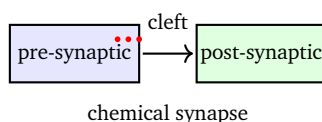


- (A) tubular secretion
- (B) selective reabsorption



- (C) active transport
- (D) ultrafiltration (glomerular filtration)

Q21. At the synapse shown, the arrival of a nerve impulse triggers the release of a chemical messenger from vesicles into the synaptic cleft to carry the signal to the next neuron. A common excitatory neurotransmitter doing this job is:

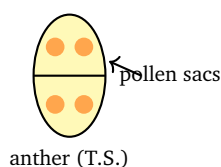


- (A) acetylcholine
- (B) insulin
- (C) haemoglobin
- (D) pepsin

Q22. A hormone that requires *iodine* for its synthesis, regulates the basal metabolic rate (BMR), and whose dietary deficiency leads to an enlarged thyroid gland (goitre) is:

- (A) insulin
- (B) adrenaline
- (C) thyroxine
- (D) glucagon

Q23. In the anther shown, the process by which the diploid microspore mother cells divide by meiosis to form haploid microspores (which mature into pollen grains) is called:



- (A) megasporogenesis
- (B) fertilisation
- (C) pollination
- (D) microsporogenesis

Q24. The fusion of a male gamete with the female gamete (egg/ovum) to form a diploid zygote is called:

- (A) parthenogenesis
- (B) syngamy (fertilisation)
- (C) budding
- (D) regeneration

Q25. In the human male, the formation of sperms (spermatozoa) from the germ cells takes place in the:

- (A) seminiferous tubules of the testis
- (B) prostate gland
- (C) urinary bladder
- (D) Graafian follicles of the ovary

Q26. Which of the following is a *surgical* method of contraception in the human female, in which the fallopian tubes are cut and tied to block the passage of the ovum?

- (A) vasectomy
- (B) the oral contraceptive pill
- (C) tubectomy
- (D) the condom

Q27. The Punnett square shows the F_2 of a dihybrid cross between two plants heterozygous for seed shape and colour ($RrYy \times RrYy$). The phenotypic ratio of the four classes in the F_2 generation is:



	<i>R Y R y r Y r y</i>			
<i>R Y</i>	<i>RRYY</i>	<i>RRYy</i>	<i>RrYY</i>	<i>RrYy</i>
<i>R y</i>	<i>RRYy</i>	<i>RRyy</i>	<i>RrYy</i>	<i>Rryy</i>
<i>r Y</i>	<i>RrYY</i>	<i>RrYy</i>	<i>rrYY</i>	<i>rrYy</i>
<i>r y</i>	<i>RrYy</i>	<i>Rryy</i>	<i>rrYy</i>	<i>rryy</i>

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

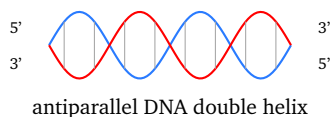
Q28. In the four o'clock plant *Mirabilis jalapa*, a cross between a red-flowered (*RR*) and a white-flowered (*rr*) plant gives pink F_1 flowers, and the F_2 shows a 1 : 2 : 1 ratio of red : pink : white. This pattern of inheritance is:

- (A) complete dominance
 (B) incomplete dominance
 (C) co-dominance
 (D) sex-linked inheritance

Q29. A human female who has only 45 chromosomes with a single X chromosome (XO), and who shows sterility and underdeveloped ovaries, is suffering from:

- (A) Turner's syndrome
 (B) Klinefelter's syndrome
 (C) Down's syndrome
 (D) Haemophilia

Q30. The model of DNA shown, in which two sugar-phosphate strands run in *opposite* (antiparallel) directions and are coiled into a right-handed double helix held together by base pairs, was proposed by:



- (A) Mendel and Morgan
- (B) Darwin and Wallace
- (C) Watson and Crick
- (D) Schleiden and Schwann

Q31. Translation, in which the genetic message is decoded to build a protein, takes place on the ribosome and uses the codons of:

- (A) rRNA read by DNA polymerase
- (B) DNA read directly by tRNA
- (C) lipids read by the Golgi body
- (D) mRNA, with tRNA bringing the matching amino acids

Q32. The theory that organisms with favourable heritable variations survive and reproduce more successfully than others (“survival of the fittest”), thereby driving evolution, was proposed by:

- (A) Jean-Baptiste Lamarck
- (B) Charles Darwin
- (C) Gregor Mendel
- (D) Hugo de Vries

Q33. Dengue fever is caused by a virus that is transmitted to humans through the bite of the:

- (A) *Aedes* mosquito
- (B) female *Anopheles* mosquito
- (C) *Culex* mosquito
- (D) housefly (*Musca*)

Q34. Which statement correctly distinguishes innate immunity from acquired immunity?



- (A) innate immunity is highly specific and develops only after exposure to a pathogen
- (B) innate immunity produces antibodies, whereas acquired immunity does not
- (C) innate immunity is non-specific and present from birth, whereas acquired immunity is pathogen-specific and develops after exposure
- (D) both innate and acquired immunity are absent at birth and identical in action

Q35. The microorganism *Saccharomyces cerevisiae*, widely used to leaven bread and to produce alcohol from sugar by fermentation, is a:

- (A) bacterium
- (B) virus
- (C) protozoan
- (D) yeast (a fungus)

Q36. In genetic engineering, a small, circular, self-replicating piece of extra-chromosomal DNA of bacteria (such as pBR322) that is used as a vehicle to carry a foreign gene into a host cell is a:

- (A) ribosome
- (B) plasmid (cloning vector)
- (C) lysosome
- (D) centromere

Q37. Humulin, the human insulin used to treat diabetes, is now manufactured on a large scale by:

- (A) genetically engineered (recombinant) bacteria carrying the human insulin gene
- (B) extracting it from the pancreas of slaughtered cattle and pigs only
- (C) chemically synthesising it from petroleum

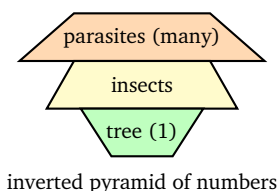


(D) collecting it from the urine of healthy donors

Q38. The polymerase chain reaction (PCR) is a technique used to:

- (A) separate proteins according to their charge
- (B) cut DNA at specific recognition sites
- (C) join two DNA fragments together
- (D) amplify (make many copies of) a specific DNA segment *in vitro*

Q39. The ecological pyramid shown represents a tree ecosystem in which a single large tree supports many herbivorous insects and still more parasites. Which type of pyramid is *inverted* (broadest at the top) in this case?



- (A) the pyramid of energy
- (B) the pyramid of numbers
- (C) the pyramid of energy and biomass together
- (D) no pyramid can ever be inverted

Q40. Global warming, the gradual rise in the average temperature of the Earth's atmosphere, is caused mainly by the increasing concentration of "greenhouse gases" that trap outgoing heat. The principal greenhouse gas responsible is:

- (A) oxygen (O₂)
- (B) nitrogen (N₂)
- (C) carbon dioxide (CO₂)
- (D) the noble gas argon



Detailed Solutions

Q1.

Solution

Concept — Kingdom Fungi: In Whittaker's five-kingdom scheme, organisms are sorted by cell type, body organisation and mode of nutrition. Fungi are eukaryotes (with a true nucleus), are mostly multicellular (the body is a mycelium of thread-like hyphae, except unicellular yeasts), and are heterotrophic. **Key fact:** Fungi feed by *absorptive heterotrophy* — they secrete digestive enzymes onto the food (a dead substrate or a host), break it down extracellularly, and then absorb the simple soluble nutrients. Most are saprophytes; some are parasites or symbionts (lichens, mycorrhizae). **Why other options are wrong:**

- (B) Monera are *prokaryotic* (bacteria), not eukaryotic.
- (C) Protista are eukaryotic but *unicellular*; (D) Plantae are autotrophic (they make food by photosynthesis), not heterotrophic by absorption.

Final Answer: Eukaryotic, multicellular, absorptive heterotrophs = Fungi ⇒

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

Q2.

Solution

Concept — Bryophytes and water: Bryophytes (mosses, liverworts, hornworts) are the simplest land plants. They have successfully colonised land but have not freed themselves from dependence on water for reproduction, which is why they are nicknamed the “amphibians of the plant kingdom”. **Key fact:** Their male gametes (antherozoids) are *flagellated* and must *swim* through a film of external water to reach and fuse with the egg in the archegonium. So even though the plant body lives on land, fertilisation absolutely needs water — exactly like an amphibian animal that lives on land but must return to water to breed. **Why other options are wrong:**

- (A) The name has nothing to do with salt versus fresh water.
- (B) Plants have no gills or lungs; (D) bryophytes are plants and are not ancestors of amphibian animals.

Final Answer: They live on land but need water for fertilisation ⇒

Answer: (C) [Go Back to Q2](#)



Q3.

Solution

Concept — Phylum Cnidaria (Coelenterata): These are aquatic, mostly marine animals with radial symmetry, a tissue-level organisation and a single body cavity (coelenteron) with one opening. Their hallmark is the presence of special stinging cells. **Key fact:** *Cnidoblasts* (cnidocytes), each containing a coiled *nematocyst*, are found on the tentacles and body. They discharge a barbed thread that injects toxin to capture prey and for defence — a feature unique to and defining of Cnidaria. *Hydra*, jellyfish, sea anemones and corals all belong here. **Why other options are wrong:**

- (A) Porifera (sponges) have a cellular grade of organisation and feed by filtering, with no cnidoblasts.
- (C) Platyhelminthes are flatworms with flame cells; (D) Annelida are segmented worms with nephridia. Neither has nematocysts.

Final Answer: Cnidoblasts/nematocysts = phylum Cnidaria ⇒

Answer: (B) [Go Back to Q3](#)

Q4.

Solution

Concept — Taxonomic hierarchy: Linnaeus arranged organisms in a series of ranked categories (taxa). Going down the ladder, each category becomes smaller and more specific, while the organisms within it share more characters. **Key fact:** The standard descending sequence is *Kingdom* > *Phylum (Division in plants)* > *Class* > *Order* > *Family* > *Genus* > *Species*. Kingdom is the largest and most inclusive; species is the smallest, basic unit containing the most closely related individuals. **Why other options are wrong:**

- (A) is the correct sequence written in the wrong direction (ascending), so it does not answer “descending order”.
- (B) wrongly places Class before Phylum; (C) wrongly places Order before Phylum and Class. Only (D) keeps every rank in its proper place.

Final Answer: Kingdom > Phylum > Class > Order > Family > Genus > Species ⇒

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



Q5.

Solution

Concept — Underground stem modifications: Certain stems grow below the soil to store food and survive unfavourable seasons. They remain stems (not roots) because they bear nodes, internodes, scale leaves and buds. **Key fact:** The *rhizome* is a horizontally growing, often fleshy underground stem (as in ginger and turmeric). It shows distinct nodes and internodes, scale leaves and axillary buds, and gives off adventitious roots below and aerial shoots above. **Why other options are wrong:**

- (B) A stem tuber (potato) is the swollen tip of an underground branch and grows downward, not horizontally like a rhizome.
- (C) A corm (*Colocasia*) is a short, vertical, condensed underground stem;
- (D) a taproot is a root and bears no nodes or buds.

Final Answer: Ginger/turmeric = rhizome \Rightarrow

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

Q6.

Solution

Concept — Family Solanaceae: This is the “potato family”, a large group of economically important plants (potato, tomato, brinjal, chilli, tobacco, *Petunia*, *Datura*). It is recognised by a characteristic and constant floral plan. **Key fact:** Solanaceae flowers are *actinomorphic* (radially symmetrical) and bisexual, with the floral formula based on five fused sepals and five fused petals, five stamens, and a *bicarpellary, syncarpous, superior ovary with axile placentation*; the carpels are placed obliquely. The fruit is a berry (tomato) or a capsule (*Datura*). **Why other options are wrong:**

- (A) Fabaceae have zygomorphic papilionaceous flowers and a monocarpellary ovary forming a legume.
- (B) Liliaceae are monocots with a trimerous perianth; (D) Poaceae (grasses) have much-reduced flowers in spikelets.

Final Answer: Actinomorphic, bicarpellary, axile placentation = Solanaceae \Rightarrow

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



Q7.

Solution

Concept — Open circulatory system: Animals have either a closed system (blood always inside vessels, as in vertebrates and annelids) or an open system (blood is pumped into open body spaces). Insects such as the cockroach have an open system. **Key fact:** In the cockroach the heart pumps the *colourless* blood, called *haemolymph*, into large body cavities (haemocoel/sinuses), where it directly bathes the tissues before slowly returning to the heart. Because it is not confined to vessels throughout, the system is “open”. The haemolymph is colourless because it does *not* carry oxygen (the tracheal system handles gas exchange). **Why**

other options are wrong:

- (A) The haemolymph is colourless, not red, and carries no oxygen.
- (C) Blood confined to capillaries describes a *closed* system; (D) the cockroach does have a tubular dorsal heart, so it is not absent.

Final Answer: Haemolymph flows freely through sinuses = open system ⇒ **B**

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

Q8.

Solution

Concept — The ribosome: Ribosomes are tiny, dense, *non-membranous* organelles made of ribosomal RNA and proteins. Each is built from a larger and a smaller sub-unit that come together on an mRNA molecule during protein synthesis. **Key fact:** The ribosome is the *site of protein synthesis (translation)* — it reads the codons of mRNA and links amino acids brought by tRNA into a polypeptide chain. Eukaryotic ribosomes are 80S; prokaryotic ones are 70S. The absence of any membrane and the two-sub-unit structure in the figure identify it. **Why**

other options are wrong:

- (A) A lysosome is a single-membrane sac of digestive enzymes.
- (B) A centriole is a cylinder of microtubules involved in spindle formation;
- (C) a peroxisome is a membrane-bound vesicle that breaks down H_2O_2 .
None of these makes protein.

Final Answer: Non-membranous, two sub-units, makes protein = ribosome ⇒ **D**

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



Q9.

Solution

Concept — The cell theory: Matthias Schleiden (1838, for plants) and Theodor Schwann (1839, for animals) jointly proposed that all living things are composed of cells and that the cell is the basic structural and functional unit of life. **Key fact:**

Rudolf Virchow (1855) completed the theory with his famous statement *omnis cellula e cellula* — “every cell arises from a pre-existing cell”. Thus new cells are formed only by the division of existing cells, ruling out spontaneous generation.

Why other options are wrong:

- (B) Spontaneous generation of cells from non-living matter is exactly what Virchow’s dictum disproves.
- (C) Both plants and animals are made of cells; (D) cells are microscopic, not the largest visible unit.

Final Answer: All organisms are cellular; new cells come from pre-existing cells

⇒

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

Q10.

Solution

Concept — Enzyme specificity: Each enzyme acts on a specific substrate (or class of substrates). This specificity arises from the precise three-dimensional shape of the enzyme’s *active site*. **Key fact:** The *lock-and-key model* (Emil Fischer, 1894) pictures the active site as a rigid “lock” whose shape exactly complements the “key” (substrate). Only a substrate of the right shape can fit and bind, which explains why an enzyme catalyses only one particular reaction. **Why other options are**

wrong:

- (A) The fluid-mosaic model describes the plasma membrane.
- (C) The sliding-filament model explains muscle contraction; (D) the semi-conservative model describes DNA replication. None of these concerns enzyme specificity.

Final Answer: Substrate fits the active site like a key in a lock ⇒

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



Q11.

Solution

Concept — Phases of mitosis: Mitosis proceeds through prophase, metaphase, anaphase and telophase, each defined by a characteristic arrangement and movement of the chromosomes. **Key fact:** In *metaphase*, the now fully condensed chromosomes line up with their centromeres along the *equatorial (metaphase) plate* of the spindle. Spindle fibres from both poles attach to the kinetochores, and this precise alignment ensures that the sister chromatids will later be pulled equally to the two poles. **Why other options are wrong:**

- (A) In prophase chromosomes condense and the spindle just begins to form; they are not yet aligned.
- (B) In anaphase the chromatids have already separated and are moving to the poles; (D) in telophase the nuclei reform after separation.

Final Answer: Alignment at the equatorial plate = metaphase \Rightarrow

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

Q12.

Solution

Concept — Meiosis as reduction division: Meiosis is the special division of germ cells that forms gametes. It consists of two successive divisions (meiosis I and II) but only one round of DNA replication. **Key fact:** Because the homologous chromosomes are separated in meiosis I, the chromosome number is *halved* — a diploid ($2n$) cell gives rise to four haploid (n) cells. This halving is why meiosis is called the *reduction division*; it is essential so that fertilisation restores the $2n$ number without doubling it each generation. **Why other options are wrong:**

- (B) Nothing in meiosis doubles the number to $4n$.
- (C) Keeping the number at $2n$ describes *mitosis*, not meiosis; (D) the nucleus is retained in the gametes, not removed.

Final Answer: It halves $2n$ to $n \Rightarrow$

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



Q13.

Solution

Concept — Root pressure: As ions are actively pumped into the root xylem at night, water follows by osmosis, building up a positive pressure called *root pressure* that pushes the xylem sap upward. **Key fact:** When transpiration is very low (cool, humid mornings) but root pressure is high, the excess water is forced out as liquid *droplets* through special pores at leaf margins called hydathodes. This loss of liquid water is *guttation*, and it is the classic demonstration of root pressure. **Why other options are wrong:**

- (A) Transpiration is loss of water as *vapour* through stomata, not liquid droplets, and is not driven by root pressure.
- (B) Imbibition is absorption of water by hydrophilic solids; (C) plasmolysis is the shrinking of protoplasm in a hypertonic solution.

Final Answer: Droplets at leaf margins demonstrating root pressure = guttation ⇒

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

Q14.

Solution

Concept — The Calvin cycle: The light-independent reactions (dark reactions) of photosynthesis occur in the *stroma* of the chloroplast and use the ATP and NADPH made in the light reactions to fix CO_2 into sugar. **Key fact:** The very first step is carboxylation: CO_2 is added to the 5-carbon acceptor ribulose-1,5-bisphosphate (RuBP) by the enzyme *RuBisCO* (ribulose bisphosphate carboxylase-oxygenase), forming two molecules of 3-phosphoglyceric acid (3-PGA). RuBisCO is the most abundant enzyme on Earth. **Why other options are wrong:**

- (A) Amylase digests starch; it has no role in CO_2 fixation.
- (C) DNA polymerase synthesises DNA; (D) pepsin digests protein in the stomach. None fixes carbon dioxide.

Final Answer: CO_2 fixation in the Calvin cycle is by RuBisCO ⇒

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



Q15.

Solution

Concept — Glycolysis: Glycolysis (the EMP pathway) is the first stage of glucose oxidation. It occurs in the *cytoplasm*, needs no oxygen, and partially breaks one 6-carbon glucose into two 3-carbon pyruvate molecules. **Key fact:** Two ATP are *used up* in the early (investment) steps, and four ATP are *produced* in the later (pay-off) steps by substrate-level phosphorylation, giving a *net gain of 2 ATP* per glucose (plus 2 NADH). The full 36–38 ATP yield comes only later, in the mitochondria.

Why other options are wrong:

- (A) 38 ATP is the total for complete *aerobic* respiration, not glycolysis alone.
- (B) The net yield is not zero — 2 are consumed but 4 are made; (D) 36 ATP again refers to the whole aerobic process.

Final Answer: Glycolysis gives a net 2 ATP \Rightarrow

[Go Back to Q15](#)

Q16.

Solution

Concept — Plant growth regulators: The five major classes are auxins, gibberellins, cytokinins, ethylene and abscisic acid, each with distinctive effects on growth and development. **Key fact:** *Gibberellins* (e.g. GA_3) cause dramatic elongation of the stem internodes, induce *bolting* (sudden elongation of the stem just before flowering) in rosette plants such as cabbage, break seed and bud dormancy, and promote germination by mobilising stored food through α -amylase. They can also make dwarf plants grow tall. **Why other options are wrong:**

- (A) Abscisic acid is a growth *inhibitor* that promotes dormancy and stomatal closure.
- (B) Ethylene promotes fruit ripening and abscission; (C) cytokinins promote cell division and delay senescence, but do not cause bolting.

Final Answer: Stem elongation, bolting and germination = gibberellins \Rightarrow

[Go Back to Q16](#)



Q17.

Solution

Concept — Protein digestion in the stomach: The gastric glands secrete an inactive precursor that is switched on by the acidic stomach contents to begin protein digestion. **Key fact:** *Pepsin* is secreted as inactive *pepsinogen* by the chief (peptic) cells; the hydrochloric acid from the parietal cells (pH about 1.5–2) converts it to active pepsin. Pepsin then hydrolyses proteins into smaller peptides and works best in this strongly *acidic* medium. **Why other options are wrong:**

- (B) Ptyalin (salivary amylase) digests starch in the mouth at near-neutral pH, not protein.
- (C) Trypsin also digests protein but acts in the small intestine in an *alkaline* medium; (D) amylase digests carbohydrates.

Final Answer: Acid-active protein enzyme of the stomach = pepsin \Rightarrow

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

Q18.

Solution

Concept — Respiratory volumes and capacities: A capacity is the sum of two or more lung volumes. Tidal volume (TV) is the air in a normal breath, IRV the extra air forcibly inhaled, and ERV the extra air forcibly exhaled. **Key fact:** The *vital capacity* (VC) = TV + IRV + ERV is the maximum volume of air a person can expel after a maximum inspiration (or, equivalently, the maximum that can be exchanged in one deep breath). It is an important measure of healthy lung function. **Why other options are wrong:**

- (A) Residual volume is the air left in the lungs even after the most forceful expiration and is *not* part of vital capacity.
- (B) Tidal volume is only the air of a single normal breath; (D) dead-space air never reaches the alveoli.

Final Answer: TV + IRV + ERV = vital capacity \Rightarrow

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



Q19.

Solution

Concept — The cardiac cycle and heart sounds: The rhythmic contraction (systole) and relaxation (diastole) of the heart constitute the cardiac cycle. The closing of the heart valves produces two audible sounds, “lub” and “dub”. **Key fact:** The first sound, “*lubb*” (low-pitched, longer), is produced by the closure of the *atrioventricular valves* (the bicuspid/mitral and tricuspid valves) at the beginning of *ventricular systole*. The second sound, “dup”, comes from the closure of the semilunar valves at the start of ventricular diastole. **Why other options are wrong:**

- (A) Closure of the semilunar valves produces the *second* sound “dub”, not “lub”.
- (C) The *opening* of valves makes no sound; (D) atrial contraction alone does not produce the first heart sound.

Final Answer: “Lub” = closure of the atrioventricular valves ⇒ **B**

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

Q20.

Solution

Concept — Urine formation: The first step of urine formation occurs at the renal corpuscle, where the glomerulus (a tuft of capillaries) sits inside the cup-shaped Bowman’s capsule. **Key fact:** The high hydrostatic blood pressure in the glomerular capillaries forces water and small solutes (glucose, amino acids, urea, ions) out through the filtration membrane into the Bowman’s capsule, while large proteins and blood cells are held back. This pressure-driven, non-selective filtration is called *ultrafiltration* (glomerular filtration). **Why other options are wrong:**

- (A) Tubular secretion adds wastes *into* the tubule later, in the DCT.
- (B) Selective reabsorption reclaims useful substances in the PCT; (C) active transport moves specific solutes against a gradient but is not the bulk filtration step at the glomerulus.

Final Answer: Pressure filtration at Bowman’s capsule = ultrafiltration ⇒ **D**

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



Q21.

Solution

Concept — The synapse: A synapse is the junction between two neurons. At a chemical synapse the electrical impulse cannot jump the gap, so it is carried across by a chemical messenger (a neurotransmitter). **Key fact:** When the impulse reaches the pre-synaptic terminal, Ca^{2+} enters and synaptic vesicles release the neurotransmitter *acetylcholine* into the synaptic cleft. It diffuses across and binds to receptors on the post-synaptic membrane, generating a new impulse in the next neuron. Acetylcholine is a major excitatory transmitter, including at the neuromuscular junction. **Why other options are wrong:**

- (B) Insulin is a pancreatic hormone controlling blood glucose, not a synaptic transmitter.
- (C) Haemoglobin carries oxygen in red blood cells; (D) pepsin is a digestive enzyme. None of these transmits nerve signals.

Final Answer: The neurotransmitter at the synapse is acetylcholine \Rightarrow

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

Q22.

Solution

Concept — The thyroid gland: The thyroid, in the neck, secretes the iodine-containing hormones thyroxine (T_4) and tri-iodothyronine (T_3), which set the body's metabolic rate. **Key fact:** *Thyroxine* needs *iodine* for its synthesis and controls the *basal metabolic rate (BMR)*, growth and tissue differentiation. When dietary iodine is deficient, the gland cannot make enough thyroxine, so it enlarges as a compensatory swelling — the condition called *goitre*. **Why other options are wrong:**

- (A) Insulin (pancreas) lowers blood glucose and contains no iodine.
- (B) Adrenaline is the “fight-or-flight” hormone of the adrenal medulla; (D) glucagon raises blood glucose. Neither needs iodine nor causes goitre.

Final Answer: Iodine-needing, BMR-controlling, goitre-on-deficiency = thyroxine \Rightarrow

Answer: (C) [Go Back to Q22](#)



Q23.

Solution

Concept — Development of the pollen grain: Inside each pollen sac (microsporangium) of the anther lie diploid microspore mother cells (pollen mother cells). These give rise to the pollen grains. **Key fact:** *Microsporogenesis* is the process in which the diploid microspore mother cells undergo *meiosis* to produce haploid microspores, usually arranged in tetrads. Each microspore then matures into a pollen grain (the male gametophyte). It is the male counterpart of megasporogenesis in the ovule. **Why other options are wrong:**

- (A) Megasporogenesis is the formation of *megaspores* in the ovule, not pollen in the anther.
- (B) Fertilisation is the fusion of gametes, which comes much later; (C) pollination is only the transfer of pollen to the stigma.

Final Answer: Meiotic formation of microspores in the anther = microsporogenesis \Rightarrow

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

Q24.

Solution

Concept — Sexual reproduction: The essence of sexual reproduction is the fusion of two haploid gametes to restore the diploid condition in the zygote, combining hereditary material from both parents. **Key fact:** *Syngamy* (fertilisation) is the fusion of a male gamete with the female gamete (egg/ovum) to form a single-celled diploid ($2n$) *zygote*. The zygote then develops into a new individual. Syngamy restores the species' chromosome number that meiosis had halved. **Why other options are wrong:**

- (A) Parthenogenesis is the development of an egg *without* fertilisation.
- (C) Budding and (D) regeneration are forms of *asexual* reproduction and involve no fusion of gametes.

Final Answer: Fusion of male gamete and egg forming a zygote = syngamy \Rightarrow

Answer: (B) [Go Back to Q24](#)



Q25.

Solution

Concept — Spermatogenesis: The formation of male gametes occurs in the paired testes, which lie outside the body in the scrotum so that the slightly lower temperature favours sperm production. **Key fact:** *Spermatogenesis* takes place in the *seminiferous tubules* of the testis. The diploid spermatogonia multiply, grow into primary spermatocytes, undergo meiosis to give haploid spermatids, which are then transformed (spermiogenesis) into mature spermatozoa, nourished by the Sertoli cells lining the tubules. **Why other options are wrong:**

- (B) The prostate gland only adds secretions to the semen; it does not make sperm.
- (C) The urinary bladder stores urine; (D) Graafian follicles are in the *ovary* and produce eggs, not sperm.

Final Answer: Sperms are formed in the seminiferous tubules \Rightarrow

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

Q26.

Solution

Concept — Methods of contraception: Birth-control methods include barrier, hormonal, intra-uterine and *surgical* (sterilisation) methods. Surgical methods block the transport of gametes. **Key fact:** *Tubectomy* is the female surgical method: a small part of each *fallopian tube* is cut and tied (ligated), so the ovum cannot meet the sperm and fertilisation cannot occur. It is a highly reliable, more or less permanent method. **Why other options are wrong:**

- (A) Vasectomy is the corresponding *male* surgical method (cutting the vas deferens), not the female one.
- (B) The oral pill is a *hormonal* method; (D) the condom is a *barrier* method. Neither is surgical.

Final Answer: Female surgical method involving the fallopian tubes = tubectomy \Rightarrow

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



Q27.

Solution

Concept — The dihybrid cross: Mendel crossed pea plants differing in two traits (e.g. seed shape, round R dominant over wrinkled r ; seed colour, yellow Y dominant over green y). The F_1 is all round-yellow ($RrYy$); selfing the F_1 gives the F_2 .

Key fact: The 4×4 Punnett square of $RrYy \times RrYy$ yields 16 combinations sorting into four phenotypes in the ratio 9 round-yellow : 3 round-green : 3 wrinkled-yellow : 1 wrinkled-green, i.e. 9:3:3:1. This ratio demonstrates Mendel's Law of Independent Assortment — the two gene pairs are inherited independently. **Why other options are wrong:**

- (A) 3 : 1 is the *monohybrid* F_2 phenotypic ratio (one trait only).
- (B) 1 : 2 : 1 is the monohybrid *genotypic* ratio (or the phenotypic ratio in incomplete dominance); (C) 1 : 1 : 1 : 1 is the ratio of a dihybrid *test cross*, not the F_2 self.

Final Answer: The dihybrid F_2 phenotypic ratio is 9 : 3 : 3 : 1 \Rightarrow **D**

Answer: (D) [Go Back to Q27](#)

Q28.

Solution

Concept — Incomplete dominance: Sometimes neither allele is fully dominant, so the heterozygote shows an *intermediate* (blended) phenotype rather than resembling one parent. This is a departure from Mendel's idea of complete dominance. **Key fact:** In *Mirabilis jalapa*, red (RR) \times white (rr) gives a pink (Rr) F_1 — a blend, because a single R allele makes only enough pigment for pink. Selfing the pink F_1 gives an F_2 of 1 red : 2 pink : 1 white (1 : 2 : 1), in which the phenotypic ratio equals the genotypic ratio. This is the hallmark of *incomplete dominance*.

Why other options are wrong:

- (A) In complete dominance the F_1 would look exactly like one parent (red), not pink.
- (C) In co-dominance *both* alleles are fully and separately expressed (e.g. AB blood group), giving no blended intermediate; (D) the trait is not located on a sex chromosome.

Final Answer: Pink F_1 and 1 : 2 : 1 F_2 = incomplete dominance \Rightarrow **B**

Answer: (B) [Go Back to Q28](#)



Q29.

Solution

Concept — Chromosomal disorders: Errors in chromosome number (aneuploidy), arising from non-disjunction during gamete formation, cause several human syndromes. The sex-chromosome count is critical for normal development.

Key fact: *Turner's syndrome* results when a female has only one X chromosome and no second sex chromosome (45, XO). Such individuals are phenotypically female but sterile, with rudimentary ovaries, short stature and lack of secondary sexual characters. **Why other options are wrong:**

- (B) Klinefelter's syndrome is 47, XXY (a male with an extra X), not 45, XO.
- (C) Down's syndrome is trisomy of chromosome 21 (an autosome), not a sex-chromosome loss; (D) haemophilia is a sex-linked gene disorder, not a change in chromosome number.

Final Answer: 45, XO female = Turner's syndrome \Rightarrow

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

Q30.

Solution

Concept — Structure of DNA: The double-helix model explained how DNA stores and copies genetic information. It was built using Chargaff's base-ratio rules and Rosalind Franklin's X-ray diffraction data. **Key fact:** In 1953 *James Watson and Francis Crick* proposed that DNA is a right-handed double helix of two *antiparallel* sugar-phosphate strands (one running 5'→3', the other 3'→5'), with the bases paired in the centre by hydrogen bonds (A–T, two bonds; G–C, three bonds). They received the Nobel Prize for this model. **Why other options are wrong:**

Key fact: In 1953 *James Watson and Francis Crick* proposed that DNA is a right-handed double helix of two *antiparallel* sugar-phosphate strands (one running 5'→3', the other 3'→5'), with the bases paired in the centre by hydrogen bonds (A–T, two bonds; G–C, three bonds). They received the Nobel Prize for this model. **Why other options are wrong:**

- (A) Mendel founded genetics and Morgan worked on linkage in *Drosophila*; neither solved the DNA structure.
- (B) Darwin and Wallace proposed natural selection; (D) Schleiden and Schwann gave the cell theory. None of these described the DNA helix.

Final Answer: The antiparallel double-helix model is by Watson and Crick \Rightarrow

Answer: (C) [Go Back to Q30](#)



Q31.

Solution

Concept — Translation (the central dogma): The flow of genetic information is DNA → RNA → protein. Transcription copies DNA into mRNA; *translation* then converts the mRNA message into a polypeptide. **Key fact:** Translation occurs on the *ribosome*. The ribosome reads the *codons* of *mRNA* three bases at a time, while *tRNA* molecules, each carrying a specific amino acid and bearing the complementary anticodon, deliver the correct amino acids. Peptide bonds join the amino acids into a protein in the order specified by the mRNA. **Why other options are wrong:**

- (A) rRNA forms part of the ribosome and DNA polymerase makes DNA, not protein.
- (B) tRNA does not read DNA directly — it reads the codons on mRNA; (C) lipids and the Golgi body do not encode protein sequence.

Final Answer: Translation uses mRNA codons with tRNA at the ribosome ⇒

[Go Back to Q31](#)

Q32.

Solution

Concept — Theories of evolution: Several thinkers tried to explain how species change over time. The most widely accepted mechanism is natural selection acting on heritable variation. **Key fact:** *Charles Darwin* (in *On the Origin of Species*, 1859) proposed *natural selection*: more offspring are produced than can survive, individuals vary, and those with favourable heritable variations survive and reproduce better (“survival of the fittest”). Over generations this differential reproduction changes the population and produces new, better-adapted species. **Why other options are wrong:**

- (A) Lamarck proposed inheritance of acquired characters (use and disuse), a different and now-rejected mechanism.
- (C) Mendel founded genetics (laws of inheritance); (D) Hugo de Vries proposed the mutation theory of evolution.

Final Answer: “Survival of the fittest” by natural selection = Darwin ⇒

[Go Back to Q32](#)



Q33.

Solution

Concept — Vector-borne viral disease: Several human diseases are spread by insect vectors. Dengue is a viral disease of warm regions transmitted by a day-biting mosquito. **Key fact:** *Dengue fever* is caused by the dengue *virus* (a flavivirus) and is transmitted by the bite of the *Aedes* mosquito (chiefly *Aedes aegypti*), which breeds in clean, stagnant water and bites during the day. It causes high fever, severe joint and muscle pain (“breakbone fever”) and a drop in platelet count.

Why other options are wrong:

- (B) The female *Anopheles* mosquito transmits *malaria* (a protozoan), not dengue.
- (C) The *Culex* mosquito transmits filariasis; (D) the housefly spreads diseases such as typhoid and cholera by contaminating food, not dengue.

Final Answer: Dengue (viral) is spread by the *Aedes* mosquito ⇒

Answer: (A) [Go Back to Q33](#)

Q34.

Solution

Concept — Two arms of immunity: The body defends itself by innate (non-specific, inborn) immunity and acquired (adaptive, specific) immunity, which work together against pathogens. **Key fact:** *Innate immunity* is present from *birth*, acts the same way against *any* pathogen (it is *non-specific*), and gives an immediate response through barriers (skin), phagocytes, inflammation and interferons. *Acquired immunity* develops *after* exposure to a specific antigen, is *pathogen-specific*, is slower at first, and has *memory* (it responds faster on a second exposure), being mediated by B- and T-lymphocytes and antibodies. **Why other options are wrong:**

- (A) Reverses the two: it is *acquired* immunity that is specific and develops after exposure.
- (B) Antibody production belongs to *acquired* immunity, not innate; (D) innate immunity is present at birth and the two are clearly different in action.

Final Answer: Innate = non-specific and inborn; acquired = specific and induced ⇒

Answer: (C) [Go Back to Q34](#)



Q35.

Solution

Concept — Microbes in human welfare: Many microorganisms are used in the food and beverage industries. Fermentation by these microbes produces useful products such as bread, alcohol, curd and cheese. **Key fact:** *Saccharomyces cerevisiae*, commonly called *baker's/brewer's yeast*, is a *single-celled fungus*. In dough it ferments sugars to CO₂, whose bubbles make the bread rise (leaven); in brewing it ferments sugars to *ethanol* and CO₂, producing alcoholic drinks. It reproduces mainly by budding. **Why other options are wrong:**

- (A) A bacterium is prokaryotic; yeast is a eukaryotic fungus.
- (B) A virus is non-cellular and cannot ferment sugar; (C) a protozoan is a single-celled animal-like protist, not the bread/alcohol organism.

Final Answer: *Saccharomyces cerevisiae* is a yeast (fungus) ⇒ **D**

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

Q36.

Solution

Concept — Cloning vectors: To introduce a foreign gene into a host cell, the gene must be carried by a *vector* — a DNA molecule that can replicate inside the host and carry the insert along with it. **Key fact:** A *plasmid* is a small, circular, double-stranded, extra-chromosomal DNA molecule found naturally in bacteria; it replicates independently of the main chromosome. Engineered plasmids such as *pBR322* are used as cloning vectors — they have an origin of replication, selectable marker genes (for antibiotic resistance) and unique restriction sites where foreign DNA is inserted. **Why other options are wrong:**

- (A) A ribosome is the site of protein synthesis, not a DNA carrier.
- (C) A lysosome is a digestive organelle; (D) a centromere is the constricted region of a chromosome. Neither carries foreign genes into a host.

Final Answer: A circular bacterial DNA carrier like pBR322 = plasmid ⇒ **B**

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



Q37.

Solution

Concept — Recombinant insulin: Before genetic engineering, insulin for diabetics was extracted from animal pancreas, which was costly and could trigger allergies. Genetic engineering allowed mass production of true human insulin. **Key fact:** *Humulin* is human insulin produced by *genetically engineered (recombinant) bacteria*. The DNA sequences for the insulin A and B chains were introduced into *Escherichia coli*; the bacteria synthesise the two chains, which are then extracted and joined by disulphide bonds to make functional human insulin. It was the first recombinant pharmaceutical approved for human use. **Why other options are wrong:**

- (B) Extraction from cattle/pig pancreas is the *old* method, not how Humulin is made, and that insulin is not identical to human insulin.
- (C) Insulin is a protein and is not synthesised from petroleum; (D) it cannot be collected from urine.

Final Answer: Humulin is made by recombinant bacteria \Rightarrow

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

Q38.

Solution

Concept — The polymerase chain reaction (PCR): PCR is a powerful laboratory method to make millions of copies of a chosen DNA segment quickly, outside a living cell. It needs a template, two primers, the four deoxynucleotides and a heat-stable DNA polymerase (Taq). **Key fact:** PCR *amplifies* a specific DNA segment *in vitro* by repeating three steps in cycles — *denaturation* (heating to separate the two strands), *annealing* (primers bind to the target ends) and *extension* (Taq polymerase synthesises new strands). Each cycle doubles the DNA, so after n cycles there are about 2^n copies. It is used in diagnosis, DNA fingerprinting and gene cloning. **Why other options are wrong:**

- (A) Separating proteins by charge describes electrophoresis, not PCR.
- (B) Cutting DNA at specific sites is done by restriction enzymes; (C) joining DNA fragments is the job of DNA ligase.

Final Answer: PCR amplifies a DNA segment *in vitro* \Rightarrow

Answer: (D) [Go Back to Q38](#)



Q39.

Solution

Concept — Ecological pyramids: A pyramid of numbers plots the number of organisms at each trophic level. Its shape depends on the ecosystem and can be upright or, in special cases, *inverted*. **Key fact:** In a *tree (forest) ecosystem*, a single large tree (the producer, at the base) supports a far larger number of herbivorous insects, which in turn support an even greater number of parasites. So the numbers *increase* up the levels and the *pyramid of numbers becomes inverted* (narrow at the base, broad at the top). In contrast, the pyramid of *energy* is always upright. **Why other options are wrong:**

- (A) The pyramid of energy can *never* be inverted, because energy always decreases up the levels (10% law).
- (C) The energy pyramid is never inverted; only numbers (and sometimes biomass) can be; (D) is wrong because a pyramid of numbers can clearly be inverted, as the tree example shows.

Final Answer: It is the pyramid of *numbers* that is inverted in a tree ecosystem ⇒

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

Q40.

Solution

Concept — The greenhouse effect and global warming: Certain atmospheric gases let in incoming short-wave sunlight but trap the long-wave heat radiated back from the Earth's surface, keeping the planet warm. A rise in these gases enhances the effect and warms the Earth. **Key fact:** The chief greenhouse gas responsible for global warming is *carbon dioxide (CO₂)*, released mainly by the burning of fossil fuels and deforestation; methane, nitrous oxide, water vapour and CFCs also contribute. The growing CO₂ concentration enhances the natural greenhouse effect, raising average global temperature, melting glaciers and changing climate. **Why other options are wrong:**

- (A) Oxygen and (B) nitrogen make up most of the air but are *not* greenhouse gases — they do not absorb infra-red radiation.
- (D) Argon is an inert noble gas and plays no role in trapping heat.

Final Answer: The principal greenhouse gas is CO₂ ⇒ **C**



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



Answer Key

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

