DEBRECENI EGYETEM

PRACTICAL EXERCISES FOR THE COURSE OF FLOODPLAIN MANAGEMENT MTMVG7009A

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A Debreceni Egyetem fejlesztése a felsőfokú oktatás minőségének és hozzáférhetőségének együttes javítása érdekében
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Content

At the conclusion of this course, the student will be familiar with:
An introduction to fluvial processes, flood studies, stream assessment and survey procedures, Rosgen stream classification systems, structures for stream restoration, design procedures, riparian-buffer re-establishment, restoration evaluation and monitoring

1. Assessment of the general characteristics of watercourses

1. A. B. C. D. E.	The freshwater biome has a lower content of _____ than the marine biome? Sulfur Plants Fish <u>Salt</u> Mammals	D
2. A. B. C. D. E.	Which of the following is not a part of the freshwater biome? Ponds Lakes Rivers Wetlands <u>Oceans</u>	E
3. A. B. C.	What type of freshwater biome is sometimes called a lentic ecosystem? <u>Lake</u> River Stream	A

D. Tributary E. Brook	
4. Which zone of a lake is the floor or bottom of the lake? A. Littoral zone B. Limnetic zone C. Euphotic zone D. Benthic zone	D
5. Which lake zone is the area closest to the shore? A. Littoral zone B. Limnetic zone C. Euphotic zone D. Benthic zone	A
6. Which of the following would be considered a lotic ecosystem? A. Lake B. River C. Pond D. Pool E. Ocean	B
7. Which of the following will have an impact on the ecology of streams and rivers? A. Flow B. Light C. Temperature D. Chemistry E. All of the above	E
8. Which of the following will vary depending on the type of geology that a river flows through? A. Flow B. Light C. Temperature D. Chemistry E. All of the above	D
9) What type of freshwater biome is a combination of land and water? A. Ponds B. Lakes C. Rivers D. Wetlands E. Oceans	D
9. What is the longest river in the world? A. Amazon River B. Mississippi River C. Nile River D. Yangtze River E. Thames River	C
10. These autotrophs are photosynthesizers such as algae and green plants that produce most of the organic nutrients for the biosphere. A. Enzymes B. Photoautotrophs C. Coliform D. Chemautotrophs	B

2. Geomorphology of streams (with short explanation)

Questions	S	Explanation
1. What type of erosion occurs where the power of the water forces air into gaps in the banks and weakens them so they collapse? A. Hydraulic Action B. Attrition C. Abrasion	A	Hydraulic action is the erosion process where the power of the water forces air into gaps in the banks and weakens them so they eventually collapse.
2. How many processes of erosion occur in a river? A. 2 B. 3 C. 4	C	There are four processes of river erosion. They are Hydraulic Action, Attrition, Abrasion and Solution.
3. What is it called when large stones are rolled along a river bed? A. Saltation B. Solution C. Traction	C	When large stones are rolled along a river bed it is called 'traction'. Traction moves the largest rocks and stones and only happens when the river has lots of energy.
4. Why might the velocity of a river fall? A. Because it enters the sea or a lake B. Because there is less water entering the river C. Both because it enters the sea or a lake, and because there is less water entering the river	C	The velocity of a river might fall because it enters the river or a lake or because there is less water entering the river. Velocity might also fall if there is more sediment in the river.
5. Which landform is found in the upper course of a river? A. Waterfalls B. Meanders C. Deltas	A	Waterfalls are found in the upper course of a river. They are formed through vertical erosion at high altitudes.
6. What feature is associated with a waterfall? A. River cliff B. Plunge pool C. Distributary	B	Plunge pools are features associated with waterfalls. As the water cascades down the waterfall, it scours out a deep pool below.
7. Where does most erosion occur in a meander bend? A. On the inside of the bend B. On the outside of the bend C. On the slip-off slope	B	Most erosion occurs on the outside bend of a meander. This is because of centrifugal force
8. What feature is formed when sediment cuts off the neck of a meander? A. A river cliff B. A slip-off slope C. An ox-bow lake	C	An ox-bow lake is formed when sediment cuts off the neck of a meander. Ox-bow lakes sometimes dry up over time.

9. What is braiding? A. Where a river splits B. Where a smaller river joins a larger river C. Where two rivers of a similar size join together	A	Braiding is where a river splits. This usually happens in the lower course of a river, where sediment is deposited and builds up to choke the main channel.
10. How is material deposited at a delta? A. In a random order B. In size order, the heaviest sediment first C. In size order, the lightest sediment first D. River processes and landforms	B	Deltas sometimes form at the mouth of a river. The heaviest sediment is deposited first as it takes the most energy to carry it.

3. Stream hydrology and hydraulics

1. A river erodes in all of the following ways EXCEPT: A. Oxidation B. Solution C. Hydraulic action D. Attrition	A
2. The term "corassion" refers to: A. The process by which rivers dissolve soluble minerals B. The process by which rivers grind their load against their bed and banks. C. The erosion of material from the bed and banks of a river by the water itself. D. Material such as rocks and stones colliding with each other	B
3. The term "hydraulic action" refers to the force of the water itself, which helps to loosen material from the bed and banks of a river. A. True B. False	A
4. The term "traction" refers to the way in which materials in the river's load are bounced along the riverbed. A. True **B. False**	B
5. Tiny particles such as silt are usually transported: A. In solution B. In suspension C. By saltation D. By traction	B
6. As a river begins to lose energy, material carried in suspension is deposited first and the rest of the load is carried farther. A. True **B. False**	B
7. Which section of a river usually has the steepest gradient? A. Lower course B. Middle course **C. Upper course** D. None of the above	C
8. Which of these features would you NOT expect to find in the upper course of a river? A. Braiding	A

B. Interlocking spurs C. Waterfalls D. Rapids	
9. As a waterfall retreats upstream, it creates a feature called: A. A V-shaped valley B. Interlocking spurs C. A river cliff **D. Gorge**	D
10. In the middle course of a river one would expect to find: A. Waterfalls and gorges B. River cliffs and slip off slopes C. Ox bow lakes and levees D. V-shaped valleys and rapids	B

4. Ecohydrology of streams

1. It refers to the release large amounts of phosphate and nitrate or organic matter into the water resulting in a lowering of oxygen levels and change in the fauna of the water A. Eutrophication B. Biomagnification C. Bioaccumulation D. Pollution	A
2. Secondary consumers belong to A. Fourth trophic level B. Third trophic level C. Second trophic level D. First trophic level	B
3. It measures how much land and water area a human population requires to produce the resource it consumes and to absorb its wastes, using prevailing technology and also called "appropriated carrying capacity". A. Biodiversity B. Ecological Footprint C. Conservation D. Sustainable Development	B
4. What are the three factors a niche includes? A. Food, competition, energy pyramid B. Habitat, ecology, food C. Habitat, food chain, oxygen cycle D. Food, Nonliving conditions, behavior E. None of the above is true	D
5. What are biotic components of an ecosystem? A. All the living things in an area B. All the nonliving things in area area C. Both living and nonliving things in an area D. All of the above	A
6. What are species? A. Group of organisms which cannot reproduce B. Group of organisms which can successfully reproduce among themselves C. Group of organisms that are immune to viruses	B
7. Acid rain is caused by the pollution of environment by	D

A. B. C. D.	Carbon dioxide and nitrogen Carbon monoxide and carbon dioxide Ozone and carbon dioxide Nitrous oxide and sulphur dioxide	
8. A. B. C. D.	The place where a river begins is called its: Spring Confluence Source Watershed	C
9. A. B. C. D.	A river which flows into another river is called a: Confluence Tributary Watershed Drainage basin	B
10. A. B. C. **D.**	The high land which separates one drainage basin from another is called a: Mountain Drainage system Confluence **Watershed**	D

5. Stream & floodplain ecology I (with short explanation)

This set of Multiple Choice Questions & Answers (MCQs) focuses on "Aquatic Ecosystems".

1. How many types of aquatic ecosystems are there? a) One b) Two c) Three d) Four	b	Explanation: There are two important aquatic ecosystems are there. One is fresh water ecosystem and one more is marine ecosystem. Again these two ecosystems are further divided into various categories. Marine includes sea whereas fresh water includes lakes, rivers and wetlands.
2. Where plants and animals live in aquatic ecosystems? a) Water b) Land c) Air d) Fire	a	Explanation: In aquatic ecosystems, plants and animals live in water. These species which are live in water adapted themselves for a different type of aquatic habitats. From breeding to all mechanisms take place inside the water only.
3. What made organisms to build their ecosystem in quatic? a) Curiosity b) Evolution c) Force from other organisms d) Increase in water level	b	Explanation: According to scientists Earth's first cellular life arose primordial in oceans. Later as evolution takes place many animals from aquatic ecosystem came to land and adopt themselves to live in the condition of land.
4. Where can we find both running water as well as stagnant water? a) Marine ecosystems b) Wetlands c) Coral reefs d) Freshwater ecosystems	d	Explanation: The freshwater ecosystems that have running water as streams and rivers. Ponds, tanks and lakes are ecosystems where water doesn't flow. So in freshwater we can find both running water as well as stagnant water.

5. In which of the following we can see fluctuation in the water level dramatically in different season? a) Coral reefs b) Brackish water c) Wetlands d) Deep oceans	c	Explanation: Wetlands are special ecosystems in which the water level fluctuates dramatically in different seasons. They have expanses of shallow water with aquatic vegetation form an ideal habitat for fish and water birds.
6. Sea is salty. a) True b) False	a	Explanation: Water flows down rivers and streams from mountains and usually there is no outflows from seas and oceans. Thus all the minerals and salts that are collected as water travels down rivers and lakes are collected in sea. Hence sea is salty.
7. Which is the largest ecosystem on Earth? a) Desert b) Forest c) Grassland d) Oceans	d	Explanation: Ocean is the largest ecosystem on Earth. When we see the Earth from space we can only see blue color. That is due to water, seventy percent of Earth's surface is covered by water, Water is vital for the survival of all living things.
8. Where can we see coral reefs? a) In pond b) In desert c) In shallow trophical seas d) In dense tropical forest	c	Explanation: Coral reefs come under Marine ecosystems. Marine ecosystems are highly saline water. Coral reefs are very rich in species and are found only in shallow trophical seas. The coral reefs in India are around the Andaman and Nicobar islands and found in the Gulf of Kutch.
9. Which of the following is among the world's most productive ecosystems in terms of biomass production? a) Pond ecosystems b) Lake ecosystems c) Brackish water ecosystems d) River ecosystems	c	Explanation: Brackish water ecosystems in river deltas are covered by mangrove forests and are among the world's most productive ecosystems in biomass production. Sunderbans in a delta of Ganges river is one of the example.
10. Which is the simplest aquatic ecosystem? a) Pond b) Stream c) Lake d) Marine	a	Explanation: Pond is the simplest aquatic ecosystems. Most ponds become dry after the rain over and are covered by terrestrial plants for the rest of the year. When the ponds fills in the monsoon season, a large number of food chains formed in the pond ecosystems.
11. Which ecosystem is known as giant permanent pond? a) Lake ecosystem b) Pond ecosystem c) Seashore ecosystem d) Marine ecosystem	a	Explanation: A lake ecosystem functions like a giant permanent pond. A large amount of its plant material is algae. Algae derives its energy directly from sun, this energy is transferred to microscopic animals which feeds on algae.

12. Beach is classified into which ecosystem? a) Lake ecosystem b) Seashore ecosystem c) Pond ecosystem d) River ecosystem	b	Explanation: Beaches can be sandy, rocky, shell covered. On each of these different types several species have evolved to occupy a separate them. There is a presence of crustaceans as crabs that make holes in the sand.
13. Humans are dependent on aquatic ecosystem. a) True b) False	a	Explanation: Humans use aquatic ecosystems for clean freshwater on which human life depends. Water is usually impounded by large dams to ensure supply throughout the year. Agriculture and industry are highly dependent on water.

6. Stream & Floodplain Ecology – Water Quality and Health II (with short explanation)

1. Which type of bacteria has a rod shaped structure? a) Bacilli b) Cocci c) Spirilla d) Vibrio	a	Explanation: Bacilli (Singular-Bacillus) has a rod shaped structure. Cocci has a spherically shaped structure, Spirilla has a spiral shaped structure and Vibrio has a comma shaped structure.
2. _____ represents the bacterial density that is most likely to be present in water. a) BOD b) COD c) MPN d) Coliform index	c	Explanation: Most Probable Number is a number that indicates the bacterial density present in water. BOD and COD are the terms related to the oxygen required by microorganism to oxidize organic and inorganic matter.
3. Which of the following is a better test to identify Coliforms? a) Coliform index b) Multiple tube fermentation c) MPN test d) Membrane filter technique	d	Explanation: Membrane filter technique is a better and simpler technique to identify Coliforms. Various results are obtained in a shorter time than multiple tube fermentation technique. MPN test and coliform index are not used now.
4. What is the temperature at which MPN test is performed? a) 35°C b) 37° C c) 40°C d) 45° C	b	Explanation: MPN test is performed at 37oC where different samples of water are mixed with lactose broth and incubated in test tubes for 48 hours.
5. Which of the following statement is/are correct regarding coliform bacteria? 1. It is gram negative 2. It is rod shaped bacteria 3. It is a harmless aerobic microorganism a) 1, 2, 3	a	Explanation: Coliform bacteria is a gram negative, rod shaped and harmless aerobic microorganism which is found in the intestine of warm blooded animals including human beings.

b) 2, 3 c) 1, 3 d) 1,2		
6. Which of the following is the disease caused by bacterial infections? a) Amoebic dysentery b) Infectious hepatitis c) Typhoid fever d) Poliomyelitis	c	Explanation:Amoebic dysentery is caused by protozoan infection, Infectious hepatitis and Poliomyelitis are caused by a viral infection and Typhoid fever is caused by bacterial infection.
7. The number of bacterial colonies by Agar plate count test should not exceed ____ per ml for potable water. a) 1 b) 10 c) 100 d) 1000	c	Explanation: Agar plate count test is a test to count the number of bacterial colonies growing on a specified medium and the permissible limit for the number of bacterial colonies is 100 per ml.
8. If the acid and gas are formed in the multiple tube fermentation technique, the test is _____ a) Positive b) Continued c) Negative d) Discarded	a	Explanation: The acid and gas formation in Multiple tube fermentation technique indicates that the test is positive and there is coliform bacteria in the sample.
9. Which bacteria cause the reddish brown deposits in the tank? a) Escherichia coli bacteria b) Bacterium coli bacteria c) Iron bacteria d) Sulphur bacteria	a	Explanation: The growth of Iron bacteria causes the discoloration of tank due to reddish brown deposits and turbidity in water.
10. Which bacteria results in the corrosion of iron and steel pipes embedded in soil? a) Escherichia coli bacteria b) Bacterium coli bacteria c) Iron bacteria d) Sulphur bacteria	d	Explanation: Sulphur bacteria cause the corrosion of iron and steel pipes embedded in soil. They are both aerobic and anaerobic and are more destructive in marshy or clay soils where anaerobic conditions prevails.

7. Arrangement of rivers and river valleys (Rosgen)

1. Waterfalls commonly form where a river crosses a band of resistant rock. A. True B. False	A
2. V- shaped valleys are usually found in the middle course of a river. A. True **B. False**	B

3. This feature is formed when a meander is abandoned by a river. A. Ox bow lake B. Braiding C. Levee D. Interlocking spurs	A
4. Natural embankments created alongside a river are known as: A. Interlocking spurs B. Deltas C. Levees D. Flood plains	C
5. A piece of land which formed as a result of a river depositing sediment into the sea is called: A. A delta B. A levee C. An example of braiding D. An ox bow lake	A
6. When a river divides for various distances into two or more channels, this is known as: A. Levees B. Ox bow lakes C. A slip off slope **D. Braiding**	D
7. In the lower course mostly _____ takes place. A. Erosion B. Transportation C. Deposition D. Traction	C
8. Which of the following is NOT an important role of a watershed? A. Filters out impurities in groundwater B. Prevents flooding C. Stores water underground to prevent drought **D. Capturing carbon dioxide from the atmosphere**	D
9. A watershed is A. A building for storing water on industrial farms. B. **An area of land that drains into a body of water,like a river or lake.** C. A tributary to a river. D. A part of the sewer system that connects the water treatment center to nearby rivers and lakes.	B
10. **The boundaries of a watershed are created by** A. Surrounding rivers and lakes. B. Political boundaries like city and county lines. C. The largest body of water in the area. D. **High points in the landscape like hilltops or mountain ridges.**	D

8. The pattern of streamflows

1. True or false: A watershed only includes the bodies of water (rivers and lakes) in a particular area. A. True **B. False**	B
2. An area of land that drains water to a common outlet is known as a what? **A. watershed** B. riverfiller	A

C. pond D. waterfilter	
3. What determines where and how water flows? A. rain B. clouds **C. topography** D. winds	C
4. Which of the following words are sometimes used interchangeably with watershed? A. drainage basin B. catchment **C. both (A) and (B)** D. neither (A) nor (B)	C
5. Which one of these terms is another name for the water cycle? A. The Vapour Cycle B. The Uni Cycle C. The Precipitation Cycle **D. The Hydrological Cycle** E. The Droplet Cycle	D
6. Is the water cycle an example of a/an... A. Closed System **B. Open System**	B
7. Which of the following terms is used to describe the point where a tributary river channel meets the main river channel? A. Estuary B. Watershed **C. Confluence** D. Drainage Basin E. Mouth	C
8. What name is given to the starting point of a river (usually an area of boggy ground)? A. Mouth **B. Source** C. Watershed D. Determination Point E. Rapid	B
9. A river's watershed usually coincides with what? **A. An area of high land** B. Another river C. A built up area D. An area of flat land E. A section of coastline	A
10. Which one of these river transportation processes describes the movement of dissolved material? A. Traction B. Saltation C. Suspension **D. Solution**	D

9. Floodplain formation

1. Which one of these river transportation processes describes the dragging of material along	A

the river bed? **A. Traction** B. Saltation C. Suspension D. Solution	
2. Which one of these river transportation processes describes the bouncing of material along the river bed? A. Traction **B. Saltation** C. Suspension D. Solution	B
3. What is the name given to the feature that results as a waterfall cuts back into the valley in which it was formed? A. Pot Hole B. Oxbow Lake C. **Gorge** D. Plunge Pool	C
4. What is the name given to a large depression in a river bed resulting from a rock fragment becoming lodged in a crack? This feature is often combined with a whirlpool on the river's surface. A. Oxbow Lake B. Plunge Pool **C. Pot Hole** D. Gorge	C
5. What name is given to the section of deep water at the foot of a waterfall? A. Pot Hole B. Gorge C. Oxbow Lake **D. Plunge Pool**	D
6. What is the name given to a lake that becomes cut off from the main river channel by the development of a meander? A. Pot Hole B. Gorge **C. Oxbow Lake** D. Plunge Pool	C
7. What is the name given to a river channel that has been separated into a number of different sections by the deposition of sediment? A. Fragmented River B. Augmented River C. Splintered River **D. Braided River** E. Split River	D
8. What is the name given to new land which is created near the mouth of a river by the deposition of a large amount of river sediment? A. Plunge Pool **B. Delta** C. Gorge D. Oxbow Lake	B
9. What is the name given to the mounds of deposits alongside a river channel? A. **Levees**	A

B. Delta C. Gorge D. Oxbow Lake	
10. Which of the following would not reduce the risk of flooding within a river's flood plain? A. Planting new trees within a nearby forest **B. Building a new car park** C. Creating a dam and reservoir further up the river's course D. Reinforcing the river's channel with concrete	B

10. Modelling of aquatic structures (with short explanation)

1. What are the four largest water reservoirs on earth in descending order? A. Glaciers, groundwater, oceans, lakes B. Glaciers, oceans, groundwater, lakes C. Glaciers, oceans, lakes, groundwater **D. Oceans, glaciers, groundwater, lakes** E. Oceans, groundwater, glaciers, lakes	D	**Oceans, glaciers, groundwater, lakes**
2. What powers the hydrologic cycle? A. Earthquakes B. Gravity C. Internal heat **D. Solar energy** E. Wind	D	**Heat from the sun evaporates water which sets the hydrologic cycle in motion.**
3. What is the release of water into the atmosphere by plants called? A. Evaporation B. Infiltration C. Precipitation D. Runoff **E. Transpiration**	E	**Transpiration is the release of water into the atmosphere by plants.** Evaporation is the dissolving of water into the atmosphere. Infiltration is the loss of surface water into the ground. Precipitation is the release of water from the atmosphere. Runoff is the movement of surface water on land.
4. What is water soaking into the ground called? A. Evaporation **B. Infiltration** C. Precipitation D. Runoff E. Transpiration	B	**Infiltration is the loss of surface water into the ground.** Transpiration is the release of water into the atmosphere by plants. Evaporation is the dissolving of water into the atmosphere. Runoff is the movement of surface water on land Precipitation is the release of water from the atmosphere.
5. What term refers to the maximum size of particle that a stream can carry? A. Capacity **B. Competence** C. Discharge	B	**Competence is the maximum size of particle that a stream can carry.** Capacity is the maximum load of solid particles that a stream can carry.

D. Load E. Saltation		Discharge is the rate of water flow in a stream. Load is the rate of sediment flow in a stream. Saltation is the jumping of particles along a stream bed.
6. What term refers to the total amount of material carried by the water of a stream or river? A. Capacity B. Competence C. Discharge **D. Load** E. Saltation	D	**Load is the rate of sediment flow in a stream.** Competence is the maximum size of particle that a stream can carry. Capacity is the maximum load of solid particles that a stream can carry. Discharge is the rate of water flow in a stream. Saltation is the jumping of particles along a stream bed.
7. What is the speed at which particles of sediment fall through a still fluid? A. Discharge B. Laminar flow **C. Settling velocity** D. Sheet flow E. Turbulent flow	C	**Settling velocity is the speed at which particles of sediment fall through a still fluid.** Discharge is the rate of water flow in a river (often measured in cubic meter per second). Laminar flow is particles moving parallel to one another. Sheet flow unchannelized surface water. Turbulent flow is particles moving in erratic patterns.
8. What is the rate of water flow in a river channel? **A. Discharge** B. Laminar flow C. Settling velocity D. Sheet flow E. Turbulent flow	A	**Discharge is the rate of water flow in a river (often measured in cubic meter per second).**
9. Where does the maximum water velocity occur in a straight river channel? A. On the bottom near the middle B. On the bottom near the shore **C. On the surface near the middle** D. On the surface near the shore E. Velocity is usually uniform throughout	C	**Velocity increases away from the river channel**. Velocity is never uniform due to friction against the river channel.
10. Where does the maximum water velocity occur in a meander bend? A. In the middle of the river channel B. On the inside of the bend **C. On the outside of the bend**	C	**Velocity is maximum on the outside of the bend, causing erosion.** Meander bends have asymmetrical water velocity patterns. Velocity is minimum on the inside of the bend, causing deposition (point bar).

11. Which feature represents an abandoned river channel? A. Backswamp B. Floodplain C. Natural levee **D. Oxbow lake** E. Yazoo tributary	D	**An oxbow lake is an abandoned meander loop.** The floodplain is the area of a river valleys that is covered by water during flood stage. Natural levees form by deposition during river flooding. A yazoo tributary is a tributary stream that parallels a river down a floodplain.

11. Watershed and river basin (with short explanation)

1. What is the border between two drainage basins called? A. Boundary B. **Divide** C. Range D. Ridge E. River	B	**Divide**
2. As stream erosion works its way toward equilibrium in a drainage basin, what is the effect on lakes and waterfalls? A. Both lakes and waterfalls are created by stream erosion. **B. Both lakes and waterfalls are destroyed by stream erosion.** C. Lakes are created but waterfalls are destroyed by stream erosion. D. Waterfalls are created but lakes are destroyed by stream erosion.	B	**Stream erosion works to create a smooth sloping profile, thus eliminating erratic profile features such as lakes and waterfalls**.
3. What factor causes a river to be braided? A. High discharge **B. High sediment load** C. Shallow gradient D. Steep gradient E. Tight channelization	B	**A high sediment load causes deposition in the channel when causes the river to constantly bifurcate.**
4. What is often formed when a mountain stream enters a broad valley? **A. Alluvial fans** B. Deltas C. Drainage basins D. Point bars E. Tributaries	A	**Alluvial fans are fan-shaped deposits that form at mountain fronts.** Deltas are formed where rivers enter a body of water and deposit their load. Drainage basins are the geographic areas drained by a given stream or river. Point bars are deposits that form on the inside of meander bends. Tributaries are the branches of a river system.
5. What features are created when rivers enter the ocean? A. Alluvial fans **B. Deltas**	B	**Deltas are formed where rivers enter a body of water and deposit their load.**

C. Drainage basins D. Point bars E. Tributaries		
6. What drainage pattern is the most common? A. Concentric **B. Dendritic** C. Radial D. Rectangular E. Trellis	B	**A dendritic drainage is the common leaf-like branching pattern.** A concentric drainage tends to develop on domal uplifts with interbedded hard and soft layers. A radial drainage tends to form where runoff is moving away from a high peak, such as a volcanic cone. A rectangular drainage tends to form where the bedrock contains perpendicular joints. A trellis pattern tends to develop in exposures of alternating soft and resistant rock.
7. What type of drainage pattern tends develop around volcanoes? A. Concentric B. Dendritic **C. Radial** D. Rectangular E. Trellis	C	**A radial drainage tends to form where runoff is moving away from a high peak, such as a volcanic cone.**
8. What is alluvium? **A. Any stream-deposited sediment** B. Back swamp mud deposits C. Bed load sediments D. Dissolved sediments E. Suspended sediments	A	**Alluvium refers to stream-deposited sediments, which usually consist of rounded and well-sorted particles.**
9. Where are distributaries found? A. At river divides **B. At river mouths** C. In drainage basins D. In floodplains E. In point bar deposits	B	**Distributary channels form at river mouths (deltas) because deposition of sediment blocks and bifurcates channels.**
10. What type of sediment load is deposited first when a river enters the ocean? A. Suspended load B. Dissolved load C. **Bed load**	C	**The bed load is quickly deposited when a river enters a lake or ocean.** The dissolved load remains dissolved in the ocean. The suspended can be carried out to sea for some distance.
11. What process leads to entrenched meander bends? A. Deposition B. Headward Erosion C. Infiltration **D. Rejuvenation** E. Stream piracy	D	Entrenching of meanders involves erosion, not deposition. Headward erosion is the extension of a drainage basin. Infiltration is water entering the ground.

		Rejuvenation is uplift that stimulates downcutting by a river. Stream piracy is the capturing of one river by another.
12. What is the ultimate result of long-term stream erosion? **A. A flat topography near sea level** B. A rectangular drainage pattern C. Deep U-shaped valleys D. Deep V-shaped valleys E. Extensive lakes	A	**Ultimately erosion erodes a landscape down to its base level.** U-shaped valleys are formed by valley glaciers. V-shaped valleys are formed in the early stages of stream erosion. Lakes are destroyed as streams fill them with sediment

13. Water flow in the floodplain (with short explanation)

1. A temporary body of water formed in a meander cut-off is what type of lake? A. Hoodoo B. Overwash C. Yazoo D. Oxbow	D	**Oxbow** After a flood, when a river may change its form, meander cut-offs are left full of water. Over time, these lakes are filled with sediment leaving scars on the land surface. They are called oxbow lakes because they resemble the U-shaped piece of wood fitted around the neck of a harnessed ox.
2. This type of stream flows parallel to another, unable to join due to the natural levees caused by the larger river. A. Ogive B. Mere C. Yazoo D. Tidal	C	**Yazoo** E.g. the Mississippi and Danube River have many yazoo streams running alongside it. The yazoo stream flows along the larger river for some distance before a 'weakness' can be found in the levees along the river.
3. The sequence of shallow-deep-shallow or wide-narrow-wide channel pattern associated with most streams is called what? A. Bowl-Ripple Sequence B. Pool-Riffle Sequence C. Deep-Shallow Sequence D. Curve-Straight Sequence	B	**Pool-Riffle Sequence** The pool-riffle sequence has many interesting differentiations. Depth, width, velocity and sediment type are just a few of the properties which change between pools and riffles. The pool-riffle sequence slowly migrates downstream over time.
4. A wadi is an Arabic term for what? A. Intermittent Stream B. Meander C. Floodplain D. Waterfall	A	**Intermittent Stream** Also known as an ephemeral stream, wadis are generally found in desert areas, where they flow occasionally and sometimes discontinuously along their course. Only after rainstorms will a wadi flow as a river.
5. An anastomosing channel is another name for what type of river? A. Straight B. Intermittent C. Meandering D. Braided	D	**Braided** Braided channels are rivers where the flow passes through a number of interlaced branches that divide and rejoin. Specifically, anastomosing channels are stable, where the braided form is somewhat permanent. In other braided streams, the pattern changes regularly, with changing flow.
6. Due to its shape, the Mississippi delta is known as what type of delta? A. Pluvial B. Tidal C. Birds Foot	C	**Birds Foot** The Mississippi and Danube-delta, when seen on maps and satellite images, appears roughly the same shape as a bird's foot. This type of delta is caused

D. Estuarine		by the large amounts of sediment carried by the river, which are deposited on and at the foot of the delta, causing it to grow outwards, sometimes in odd directions.
7. During the last ice age there were great rivers flowing beneath the ice caps. As the ice melted, these landforms were left on the land surface where the rivers once flowed. A. Dykes B. Moulins C. Eskers D. Kaolins		**Eskers** Eskers can be hundreds of kilometres in length and 100 metres high. Eskers are essentially relic rivers, having meanders, tributaries and deltas associated with them.
8. Over time, a meandering channel migrates, both downstream and from side-to-side. This process is known as what? A. Meander Refraction B. Pneumatolysis C. Lateral Accretion D. Stretching	C	**Lateral Accretion** As bed sediments accumulate on the sides of rivers, usually on the inside of meanders, the river is forced further outward and cuts into the outside bank. This causes the river to migrate.
9. When a river floods, it deposits fine sediments on the floodplain. These sediments are called what? A. Overbank deposits B. Turbidity Layers C. Lateral Accretions D. Sinters	A	**Overbank deposits** These fine particles can be deposited a great distance from the river itself, depending on the size of the flood. During large floods, it is possible for large sediments, such as pebbles or cobbles to be deposited on the floodplain.
10. Which of these is a NOT structure used to control the flow of a river or stream? A. Dam B. Hydrograph C. Levee D. Weir	B	**Hydrograph** A hydrograph is a chart which documents the flow of a waterway. Recordings can be taken at many points on a river. The other options control a river's flow to help prevent flooding or maintain river and/or dam levels.

1. The flow of water after spilling over the weir crest in chute spillway and side channel spillway respectively are (A) At right angle and parallel to weir crest (B) Parallel and at right angle to weir crest (C) Parallel to weir crest in both (D) At right angle to weir crest in both	A
2. Estimated hydrodynamic pressure due to earthquake acts at a height of (A) 3H/4 above the base (B) 3H/4 below the water surface (C) 4H/3 above the base (D) 4H below the water surface, where H is the depth of water.	C

3. Select the correct statement. (A) A meander increases the river length but a cut off reduces the river length (B) A cut-off increases the river length but a meander reduces the river length (C) Both meander and cut-off increase the river length (D) Both meander and cut-off decrease the river length	A
4. Select the incorrect statement. (A) Intensive irrigation should be avoided in areas susceptible to water logging (B) Extensive irrigation should be adopted in areas susceptible to water logging (C) Lift irrigation increases water logging (D) All of the above	C
5. The flow-mass curve is graphical representation of (A) Cumulative discharge and time (B) Discharge and percentage probability of flow being equalled or exceeded (C) Cumulative discharge, volume and time in chronological order (D) Discharge and time in chronological order	C
6. Main purpose of mean water training for rivers is (A) Flood control (B) To provide sufficient depth of water in navigable channels, during low water periods (C) To preserve the channel in good shape by efficient disposal of suspended and bed load (D) All of the above	C
7. A divide wall is provided (A) At right angle to the axis of weir (B) Parallel to the axis of weir and upstream of it (C) Parallel to the axis of weir and downstream of it (D) At an inclination to the axis of weir	A
8. Isohyets are the imaginary lines joining the points of equal (A) Pressure (B) Height (C) Humidity (D) Rainfall	D
9. The time required by rain water to reach the outlet of drainage basin, is generally called (A) Time of concentration (B) Time of overland flow (C) Concentration time of overland flow (D) Duration of the rainfall	A
10. Disposal of extra excavated earth of canals, is utilized to provide a spoil bank on A. Left side B. Right side C. Both sides D. All the above	D
11. Pick up the correct statement from the following: (A) The specified duration of unit hydrograph, is called unit duration (B) The rain during specified duration, is called unit storm (C) The number of unit hydrographs for a given basin, is theoretically infinite (D) All the above	D
12. The drainage water intercepting the canal can be disposed of by passing the canal below the drainage in	C

(A) Aqueduct and syphon aqueduct (B) Aqueduct and super passage (C) Super passage and canal syphon (D) Level crossing	
13. River training for depth is achieved by (A) Groynes (B) Construction of dykes or leaves (C) Both (A) and (B) (D) Groynes and bandalling	D
14. Pick up the correct statement from the following: (A) A confined bed of impervious material laid over an aquifer, is known as an aquiclude (B) The top most water bearing strata having no aquifer, is known as non-artesian aquifer (C) The ordinary gravity wells which supply water from the top most water bearing strata, are called water table wells (D) All the above	D

14. Summary and control questions

15. Effective precipitation for a crop may be defined as A. Total precipitation minus the loss due to evaporation B. Total precipitation minus the loss due to infiltration C. Total precipitation during the crop period D. Available water stored in soil within root zone of the crop	D
16. A land is known as waterlogged (A) When the permanent wilting point is reached (B) When gravity drainage has ceased (C) Capillary fringe reaches the root zone of plants (D) None of the above	C
17. A hyetograph is a graphical representation of (A) Rainfall intensity and time (B) Rainfall depth and time (C) Discharge and time (D) Cumulative rainfall and time	A
18. Pick up the correct statement from the following: (A) Hydrograph is a plot of discharge and time (B) In hydrographs, time is plotted on X-axis (C) The maximum flow in the river due to rainfall, is called peak flow (D) All the above	D
19. Which of the following methods is used to estimate flood discharge based on high water marks left over in the past? (A) Slope-area method (B) Area-velocity method (C) Moving boat method (D) Ultrasonic method	A
20. If the dew point is greater than 0°C (A) Dew will be formed (B) Frost will be formed	A

(C) Vapours will be formed (D) None of these	
21. A land is said to be water-logged if its soil pores within A. A depth of 40 cm are saturated B. A depth of 50 cm are saturated C. Root zone of the crops are saturated D. All the above	C
22. An artesian aquifer is the one where A. water surface under the ground is at atmospheric pressure B. water is under pressure between two impervious strata C. water table serves as upper surface of zone of saturation D. none of the above	B
23. The ratio of average values of shear stresses produced on the bed and the banks of a channel due to flowing water is A. less than 1 B. equal to 1 C. greater than 1 D. equal to zero	C
24. The stream which does not have any base flow contribution is called A. perennial stream B. intermittent stream C. ephemeral stream D. none of the above	C
25. A river bend characterized by silting A. scouring on concave side B. silting on convex side C. scouring on convex side and on concave side D. scouring on concave side and silting on convex side	D
26. The uplift pressure on the face of a drainage gallery in a dam is taken as (A) Hydrostatic pressure at toe (B) Average of hydrostatic pressure at toe and heel (C) Two-third of hydrostatic pressure at toe plus one-third of hydrostatic pressure at heel (D) None of the above	C
27. As compared to gravity dams, earthen dams (A) Are costlier (B) Are less susceptible to failure (C) Require sound rock foundations (D) Require less skilled labour	D
28. The radius of influence is (A) Radius of the main well (B) Distance from the wall of main well to the point of zero draw down (C) Distance from the centre of main well to the point of zero draw down (D) None of these	C

1. Match the following words to their definitions.

Precipitation, runoff, condensation, evaporation, transpiration

	Rain, Snow, Sleet, Freezing rain, or hail

	water changing from a liquid to a gas
	water that travels cross the surface of the land to river or stream
	Trees and plants releasing water vapor
	the process by which water changes from a gas to a liquid

Solution:

	Correct answers
precipitation	Rain, Snow, Sleet, Freezing rain, or hail
evaporation	water changing from a liquid to a gas
runoff	water that travels cross the surface of the land to river or stream
transpiration	Trees and plants releasing water vapor
condensation	the process by which water changes from a gas to a liquid

2. Match the following words to their definitions.

Fresh, nonpoint source, divide,flood plain, watershed

	an area of land that drains into a river system.
	3% of Earth's water is this type
	when one watershed is separated from another by a ridge of land
	the type of pollution that is hard to tell exactly where it comes from (agricultural runoff or litter)
	relatively flat land that may be under water if a river or stream overflows its banks

Solution:

	Correct answers
watershed	an area of land that drains into a river system.
fresh	3% of Earth's water is this type
divide	when one watershed is separated from another by a ridge of land
nonpoint source	the type of pollution that is hard to tell exactly where it comes from (agricultural runoff or litter)
flood plain	relatively flat land that may be under water if a river or stream overflows its banks

3. Match the following words to their definitions!

Pollutant, Tributaries, Point source, Groundwater

	Type of pollution where you can easily identify the source
	A smaller stream or river that joins a main river
	Water that fills the cracks and pores in underground soil and rock layers
	A material that causes water to be unclean

Solution:

	Correct answers
Point source	Type of pollution where you can easily identify the source
Tributaries	A smaller stream or river that joins a main river
Groundwater	Water that fills the cracks and pores in underground soil and rock layers
Pollutant	A material that causes water to be unclean

4. Match the following words to their definitions.

Wetland, brackish, upstream, salt, estuary

	place where fresh water and salt water meet
	97% of the water on Earth is this type
	low lying areas saturated with water ... includes marshes and swamps
	direction of a river source
	mixture of fresh and salt water

Solution:

	Correct answers
estuary	place where fresh water and salt water meet
salt	97% of the water on Earth is this type
wetland	low lying areas saturated with water ... includes marshes and swamps
upstream	direction of a river source
brackish	mixture of fresh and salt water