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॥ आपकी सफलता, हमारी प्रतिबद्धता ॥

1. Answer C

Solution:

1. Ajmer Division - 6 districts

Ajmer, Beawar, Bhilwara, Didwana-Kuchaman, Nagaur, Tonk

2. Bharatpur Division - 5 districts

Bharatpur, Deeg, Dholpur, Karauli, Sawai Madhopur

3. Bikaner Division - 4 districts

Bikaner, Churu, Hanumangarh, Sri Ganganagar

4. Jaipur Division - 7 districts

Alwar, Dausa, Jaipur, Jhunjhunu, Khairthal-Tijara, Kotputli-Behror, Sikar

5. Jodhpur Division - 8 districts

Balotra, Barmer, Jaisalmer, Jalore, Jodhpur, Pali, Phalodi, Sirohi

6. Kota Division - 4 districts

Baran, Bundi, Jhalawar, Kota

7. Udaipur Division - 7 districts

Banswara, Chittorgarh, Dungarpur, Pratapgarh, Rajsamand, Salumbar, Udaipur

1. अजमेर संभाग - 6 जिले

अजमेर, ब्यावर, भीलवाड़ा, डीडवाना-कुचामन, नागौर, टोंक

2. भरतपुर संभाग - 5 जिले

भरतपुर, डीग, धौलपुर, करौली, सवाई माधोपुर

3. बीकानेर संभाग - 4 जिले

बीकानेर, चूरू, हनुमानगढ़, श्रीगंगानगर

4. जयपुर संभाग - 7 जिले

अलवर, दौसा, जयपुर, झुंझुनूं, खैरथल-तिजारा, कोटपूतली-बहरोड़, सीकर

5. जोधपुर संभाग - 8 जिले

बालोतरा, बाड़मेर, जैसलमेर, जालौर, जोधपुर, पाली, फलोदी, सिरौही

6. कोटा संभाग - 4 जिले

बारां, बूंदी, झालावाड़, कोटा

7. उदयपुर संभाग - 7 जिले

बांसवाड़ा, चित्तौड़गढ़, डूंगरपुर, प्रतापगढ़, राजसमंद, सलूंबर, उदयपुर

2. Answer B

Solution

Neighboring States **Districts of Rajasthan**

1. Punjab -

Sri Ganganagar, Hanumangarh.

2. Haryana -

Hanumangarh, Churu, Jhunjhunu, Sikar, Kotputli-Behror, Khairthal-Tijara, Alwar, Deeg.

3. Uttar Pradesh -

Deeg, Bharatpur, Dholpur.

4. Madhya Pradesh -

Dang Region - Dholpur, Karauli, Sawai Madhopur. Hadoti - Kota, Baran, Jhalawar.

5. Gujarat -

South Rajasthan -

Chittorgarh, Bhilwara, Pratapgarh, Banswara.

East of Aravalli -

Udaipur, Dungarpur, Banswara.

West of Aravalli -

Barmer, Jalore, Sirohi.

पड़ोसी राज्य

राजस्थान के जिले

1. पंजाब -

श्री गंगानगर, हनुमानगढ़.

2. हरियाणा -

हनुमानगढ़., चूरू, सुन्डुनूं, सीकर, कोटपुतली- बहरोड़, खैरथल-तिजारा, अलवर, डीग

3. उत्तरप्रदेश -

डीग, भरतपुर, धौलपुर ।

4. मध्यप्रदेश -

डांग क्षेत्र - धौलपुर, करौली, सवाई माधोपुर हाड़ौती - कोटा, बारां, सालावाड़. द.राज. - चित्तौड़गढ़, भीलवाड़ा, प्रतापगढ़, बांसवाड़ा

5. गुजरात-

अरावली के पूर्व में - उदयपुर, डूंगरपुर, बाँसवाड़ा अरावली के पश्चिम में - बाड़मेर. जालोर, सिरौही

3. Answer A

Solution:

पूर्व से पश्चिम तथा उत्तर से दक्षिण

Extra - 4 प्रदेशों का ढाल

प्रदेश	ढाल	क्षेत्रफल
पश्चिमी मरुस्थल	पूर्व से पश्चिम + उत्तर से दक्षिण	61.11%
अरावली प्रदेश	दक्षिण-पश्चिम से उत्तर-पूर्व	9%
पूर्वी मैदान	पश्चिम से पूर्व	23.3%
दक्षिण-पूर्वी पठार (हाड़ौती)	दक्षिण से उत्तर	6.8%

East to West and North to South

Slope of the 4 Regions

Region | Slope | Area |

Western Desert | East to West + North to South
| 61.11% |

Aravalli Region | Southwest to Northeast | 9%
|

Eastern Plains | West to East | 23.3% |

South-Eastern Plateau (Hadoti) | South to
North | 6.8% |

4. Answer C

Solution:

Leelgarh - 874 m

Raghunathgarh - 1055 m

Achalgarh - 1380 m

Kumbhalgarh - 1224 m

लीलगढ़ - 874 मी

रघुनाथगढ़ - 1055 मी

अचल गढ़ - 1380 मी

कुंभलगढ़ - 1224 मी

5. Answer B

Solution:

चंदवाड़ी की स्थिति: यह मुकुंदरा पहाड़ियों की सबसे ऊंची चोटी है, जो कोटा और झालावाड़ के क्षेत्र में आती है

शाहाबाद उच्च-भूमि बारां जिले में है

Location of Chandwari: It is the highest peak of the Mukundra Hills, situated in the Kota-Jhalawar region.

Shahabad Highlands: The Shahabad Highlands are located in Baran district.

6. Answer C

Solution:

This plain is divided from west to east by the 50 cm isohyet.

The 40 cm line separates the desert from the semi-desert, while the 50 cm line divides the eastern plain into Bangar and Khadar.

यह मैदान पश्चिम से पूर्व की ओर 50 से.मी. समवर्षा रेखा द्वारा विभाजित किया जाता है।

50 cm line into Bangar and Khadar. / 40 सेमी रेखा मरुस्थल व अर्ध-मरुस्थल को अलग करती है, पूर्वी मैदान को 50 सेमी रेखा बाँगर व खादर में बाँटती है।

7. Answer C

Solution:

South-Eastern Plateau Region / Hadauti / Lava Plateau: This region comprises 6.89 percent of the state's total area. Its average elevation is 500 meters. The Hadauti Plateau is the northern extension of the Malwa Plateau; it was formed (during the Cretaceous period) from basaltic lava rocks and Vindhyan rock formations. Following the reorganization of districts, there are six districts within the south-eastern plateau region: Kota, Bundi, Jhalawar, Bhilwara (Bijolia), Chittorgarh (Rawatbhata), and Baran. This plateau region can be divided into two parts—

दक्षिणी-पूर्वी पठारी प्रदेश / हाड़ौती /

लावा पठार : इस क्षेत्र में राज्य का 6.89 प्रतिशत भाग आता है। इसकी औसत ऊँचाई 500 मीटर है। हाड़ौती पठार मालवा पठार का उत्तरी विस्तार है। जिसका निर्माण (क्रिटेशियस काल) बेसाल्ट लावा चट्टानों एवं विन्ध्यन शैलों से हुआ है। नये जिलों के पुनर्गठन के उपरान्त दक्षिणी-पूर्वी पठारी क्षेत्र के अन्तर्गत जिलों की संख्या 6 है, यथा- कोटा, बूँदी, झालावाड़, भीलवाड़ा (बिजोलिया), चित्तौड़गढ़ (रावतभाटा), बारां। यह पठारी प्रदेश दो भागों में बाँटा जा सकता है-

8. Answer A

Solution:

Rajsamand (highest number of mountain passes in Rajasthan) – Kamli Ghat, Goram Ghat, Jirawal ki Naal (Paglya ki Naal), Hathiguda Naal. Sirohi – Peepli, Borang Pass.

Bundi – Ramgarh-Khatkhat, Jetawas, Lakheri Pass.

Beawar – Five passes of the Central Aravalli ranges are located here: Bar (also located in Pali), Pakheria/Parveria, Shivpur Ghat, Debari (also located in Udaipur), and Sura Ghat (Beawar-Bhilwara route).

Udaipur – Hathi Naal, Phulwari ki Naal, Kevda ki Naal, Debari ki Naal.

Salumbar – Dhebar Pass.

Pali – Someshwar and Desuri ki Naal are located here.

राजसमन्द (राजस्थान में सर्वाधिक दरें) - कामली घाट, गोरम घाट, जीरावल की नाल (पगल्या की नाल), हाथीगुड़ा नाल।

सिरोही - पीपली, बोरांग दर्रा

बूंदी - रामगढ़-खटखड़, जेतावास, लाखेरी दर्रा

ब्यावर - मध्य अरावली श्रेणियों के पाँच दरें स्थित हैं -बर (पाली में भी स्थित), पखेरिया/ परवेरिया, शिवपुर घाट, देबारी (उदयपुर में भी स्थित) तथा सुरा घाट (ब्यावर-भीलवाड़ा मार्ग)

उदयपुर- हाथी नाल, फुलवारी की नाल, केवड़ा की नाल, देबारी की नाल।

सलूमबर- डेबर दर्रा

पाली - सोमेश्वर और देसूरी की नाल स्थित हैं।

9.

Answer B

Solution:

कारण (R), कथन (A) की सीधी और पूर्ण व्याख्या नहीं करता। क्योंकि राजस्थान के शुष्क और अर्द्ध-शुष्क होने का मुख्य कारण सिर्फ अक्षांशीय स्थिति नहीं है, बल्कि इसमें समुद्र से दूरी, अरावली की दिशा, मानसून की अनुपलब्धता और धरातलीय संरचना भी प्रमुख कारण है।

Reason (R) does not provide a direct and complete explanation of Assertion (A), because Rajasthan's arid and semi-arid conditions are not solely due to its latitudinal location. Other major factors include its distance from the sea, the orientation of the Aravalli Range, inadequate monsoon rainfall, and its topography.

10.

Answer A

Solution:

Meaning of Caw:

C = Subtropical

a = Hot summer

w = Dry winter

1. South-Eastern Region

Hadoti Plateau — Kota, Baran, Bundi, Jhalawar, Sawai Madhopur, Bhilwara, and the southern part of Chittorgarh.

This region receives **80-100 cm of rainfall** and

Pattern

Examples

Decreases from east to west

Dholpur (80 cm) → Jaipur (55 cm) → Bikaner (25 cm)

Decreases from southeast to northwest

Jhalawar (100 cm) → Kota (75 cm) → Ganganagar (20 cm)

Highest rainfall

Jhalawar / Banswara

Lowest rainfall

Jaisalmer (15 cm)

falls under the **Caw climatic type**.

Caw का मतलब -

C = उपोष्ण कटिबंधीय - a = गर्म ग्रीष्म - w = शीतकाल में शुष्क

1. दक्षिण-पूर्वी क्षेत्र -

हाड़ौती पठार - कोटा-बारां-बूंदी-झालावाड़ - सवाईमाधोपुर-भीलवाड़ा-चित्तौड़गढ़ का दक्षिण भाग।

यहाँ वर्षा 80-100cm - Caw ही है।

Answer A

Solution:

Rainfall decreases **from east to west** and **from south to north**.

Dholpur: 75-80 cm — Located in the far east, closest to the Bay of Bengal monsoon; part of the Chambal Basin.

Alwar: 60-65 cm — Slightly farther west; located east of the Aravalli Range.

Jhunjhunu: 40-45 cm — Farther west; a semi-desert region in Shekhawati.

Extra — General Pattern of Rainfall

वर्षा पूर्व से पश्चिम घटती है - दक्षिण से उत्तर भी घटती है।

धौलपुर - 75-80cm - सबसे पूर्व में - बंगाल की खाड़ी के मानसून के सबसे करीब - चंबल बेसिन।

अलवर - 60-65cm - थोड़ा पश्चिम - अरावली के पूर्व में।

झुंझुनूं - 40-45cm - और पश्चिम - अर्द्ध-मरुस्थलीय - शेखावाटी।

Extra - वर्षा का सामान्य नियम -

| नियम

| उदाहरण |

पूर्व से पश्चिम घटती है

| धौलपुर (80) जयपुर (55)

बीकानेर (25) |

दक्षिण-पूर्व से उत्तर-पश्चिम घटती है |

झालावाड़ (100) कोटा (75) गंगानगर (20) |

सबसे ज्यादा वर्षा

| झालावाड़ / बांसवाड़ा |

सबसे कम वर्षा

| जैसलमेर (15cm) |

11.

12. Answer A
Solution:
A. Gaib Sagar – Dungarpur
B. Bhanwar Samand Lake – Pratapgarh
C. Gadisar Lake – Jaisalmer
D. Naulakha Lake – Bundi
A. गैबसागर – डूंगरपुर
B. भंवरसमंद झील – प्रतापगढ़
C. गढ़ीसर झील – जैसलमेर
D. नवलखा झील – बूंदी
13. Answer D
Solution:
1. **Gandhi Sagar** – Mandsaur (Madhya Pradesh)
2. **Rana Pratap Sagar** – Chittorgarh (Rawatbhata)
3. **Jawahar Sagar** – Kota–Bundi border
4. **Kota Barrage** – Kota
The question asks for the order **from the river's mouth towards its source**, so the sequence is reversed:
Kota Barrage → Jawahar Sagar → Rana Pratap Sagar → Gandhi Sagar
1. गांधी सागर - मंदसौर (MP)
2. राणा प्रताप सागर - चित्तौड़गढ़ (रावतभाटा)
3. जवाहर सागर - कोटा-बूंदी सीमा
4. कोटा बैराज - कोटा
मुहाने से उद्गम की ओर पूछा है - उल्टा -
- कोटा बैराज - जवाहर सागर - प्रताप सागर - गांधी सागर
14. Answer C
Solution:
The Banganga River originates near Bairath (Viratnagar, Kotputli-Behror), but it no longer reaches the Bay of Bengal.
At present, it forms part of an **inland drainage system** and disappears in **Bharatpur**.
बाणगंगा बैराठ (विराटनगर, कोटपूतली-बहरोड़) से निकलती तो है - पर अब बंगाल की खाड़ी में नहीं जाती।
वर्तमान में यह आंतरिक अपवाह / लुप्त हो गई है - भरतपुर में लुप्त
15. Answer D
Solution:
Parwan River: Originates in the Malwa Plateau (Madhya Pradesh) and enters Rajasthan through Khadibor/Kheribor village in Jhalawar district.

- Mej River:** Flows through Bhilwara and Bundi; a tributary of the Banas River.
Chakan River: Flows through Bundi and Kota; joins the Chambal River near Karanpura.
Brahmani/Bamani River: Flows through Chittorgarh and Bhilwara; joins the Chambal River near Bhainsrorgarh.
परवन नदी मालवा के पठार (मध्य प्रदेश) से निकलकर राजस्थान के झालावाड़ जिले (खड़ीबोर / खेरीबोर गांव) से प्रवेश करती है।
मेज भीलवाड़ा-बूंदी में - बनास की सहायक - बूंदी-भीलवाड़ा
चाकण बूंदी-कोटा में - चंबल की सहायक - करणपुरा के पास चंबल में
ब्राह्मणी / बामणी - चित्तौड़गढ़-भीलवाड़ा में - चंबल की सहायक - भैंसरोड़गढ़ के पास चंबल में
16. Answer C
Solution:
A. **Bigod** – Banas, Berach, Menal
B. **Rajmahal** – Banas, Dai, Khari
C. **Rameshwar Ghat** – Banas, Chambal, Seep
D. **Beneshwar** – Som, Mahi, Jakham
A. बीगोद - बनास, बेड़च, मेनाल
B. राजमहल - बनास, डाई, खारी
C. रामेश्वर घाट - बनास, चंबल, सीप
D. बेणेश्वर - सोम, माही, जाखम
17. Answer C
Solution:
Mountain Soils – Lithosols
Found in the Aravalli region—Udaipur, Rajsamand, Chittorgarh, and Sirohi. These soils occur on slopes and are shallow, gravelly, stony, and immature. They are called **Lithosols**.
पर्वतीय मृदाएं - लिथोसोल्स
- अरावली क्षेत्र - उदयपुर, राजसमंद, चित्तौड़, सिरोही - ढालू -
उथली - बजरी-पत्थर वाली - अपरिपक्व - लिथोसोल्स कहते हैं।
18. Answer B
Solution:
A. Entisols – Torripsamments
B. Aridisols – Camborthids
C. Alfisols – Haplustalfs
D. Vertisols – Pellusterts
A. एंटीसोल - टोरी समेंट्स
B. एरिडोसोल - कैम्बो ऑर्थिड्स
C. अल्फीसोल्स - हेल्प्युस्टाल्फ्स
D. वर्टीसोल्स - पेल्युस्टर्ट्स

19. Answer A

Solution:

Monsoon Deciduous Forests / Mixed Deciduous Forests

Distribution: Eastern Plains

Forest Area: 28.38%

Vegetation: Mango, Sal, Bamboo, Khair, Amla, Sal, Teak, Shisham, and Rosewood.

Southeastern Rajasthan: Receives the highest rainfall—50–80 cm. These forests occur in the Mewar–Hadoti region, including Udaipur, Chittorgarh, Rajsamand, Kota, Baran, Bundi, and Jhalawar.

मानसूनी पतझड़ वन / मिश्रित पतझड़ वन-

विस्तार:- पूर्वी मैदानी प्रदेश

वन क्षेत्र:- 28.38%

वनस्पति:- आम, साल, बांस, खैर, आँवला, साल, सागवान, शीशम, रोजवुड

दक्षिण-पूर्वी राजस्थान - सबसे ज्यादा वर्षा - 50-80 cm - मेवाड़-हाड़ौती - उदयपुर, चित्तौड़, राजसमंद, कोटा, बारां, बूंदी, झालावाड़।

20. Answer A

Solution:

Tiger Reserve Districts

Ranthambore Tiger Reserve Sawai Madhopur, Bundi, Tonk

Mukundra Hills Tiger Reserve Kota, Bundi, Jhalawar, Chittorgarh

Ramgarh Vishdhari Tiger Reserve Kota, Bundi, Jhalawar

बाघ अभयारण्य जिला
रणथंभौर टाइगर रिजर्व सवाईमाधोपुर, बूंदी, टोंक
मुकुंदरा हिल्स टाइगर रिजर्व कोटा, बूंदी, झालावाड़, चित्तौड़गढ़
रामगढ़ विषधारी टाइगर रिजर्व कोटा, बूंदी, झालावाड़

21. Answer D

Solution:

Mahua = Madhuca longifolia / Madhuca indica

KEY POINTS

- **Palash:** Also called the “Flame of the Forest.”

- **Khejri:** The state tree of Rajasthan.
- **Rohida:** The state flower of Rajasthan.
- **Mahua:** Called the “Kalpavriksha” (wish-fulfilling tree) in tribal regions.

महुआ = Madhuca longifolia / Madhuca indica

KEY POINTS

पलास = “जंगल की आग” भी कहते हैं

खेजड़ी = राजस्थान का राज्य वृक्ष

रोहिडा = राजस्थान का राज्य पुष्प

महुआ = आदिवासी क्षेत्रों में “कल्पवृक्ष” कहा जाता है

22. Answer C

Solution:

S. No.	Wildlife Sanctuary	District
1	Jawahar Sagar	Kota
2	Sawai Mansingh	Sawai Madhopur
3	Jamwa Ramgarh	Jaipur
4	Ramsagar	Dholpur
क्रम	अभयारण्य	जिला
1	जवाहर सागर	कोटा
2	सवाई मानसिंह	सवाई माधोपुर
3	जमवा रामगढ़	जयपुर
4	रामसागर	धौलपुर

23. Answer B

Solution:

Churu has the lowest forest cover.

चूरु में न्यूनतम वन आवरण है

24. Answer B

Solution:

Mount Abu Wildlife Sanctuary, Sirohi

This sanctuary is famous for its **jungle fowl**.

माउन्ट आबू वन्य जीव अभयारण्य, सिरौही

ये अभयारण्य “जंगली मुर्गे” के लिए प्रसिद्ध है।

25. Answer C

Solution:

The Government of Rajasthan established the **Department of Environment in September 1983**. To address the challenging tasks of environmental protection and biodiversity conservation, the **Directorate of Environment and Climate Change was established in 2019**. राजस्थान सरकार ने सितम्बर 1983 में पर्यावरण विभाग की स्थापना की है। पर्यावरण संरक्षण और जैव विविधता संरक्षण के कठिन कार्य को संबोधित करने के लिए 2019 में पर्यावरण और जलवायु परिवर्तन निदेशालय की स्थापना की गई।

26. Answer B

Solution:

The **Magra Regional Development Programme**, launched in **2005-06**, operates in the Magra region across five districts: **Beawar (formerly part of Ajmer), Bhilwara, Pali, Chittorgarh, and Rajsamand**. It is a **100% state-funded scheme**.

मगरा क्षेत्रीय विकास कार्यक्रम (2005-06 से प्रारम्भ) - राज्य के पाँच जिलों (मगरा क्षेत्र) ब्यावर (पूर्व अजमेर), भीलवाड़ा, पाली, चित्तौड़गढ़, राजसमंद में कार्यरत यह शत-प्रतिशत राज्य वित्त पोषित योजना है।

27. Answer C

Solution:

Kharif Crops: Sown in June-July and harvested in October-November. They depend on rainfall.

Crop	Season	Major Producing Districts
Wheat	Rabi	Ganganagar, Hanumangarh, Bikaner
Maize	Kharif	Udaipur, Bhilwara, Chittorgarh
Pearl Millet (Bajra)	Kharif	Barmer, Jaipur, Alwar
Cotton	Kharif	Ganganagar, Hanumangarh

खरीफ फसलें: जून-जुलाई में बोई जाती हैं, अक्टूबर-नवंबर में काटी जाती हैं।

बारिश पर निर्भर।

फसल	ऋतु	प्रमुख उत्पादक जिले
गेहूं	रबी	गंगानगर, हनुमानगढ़, बीकानेर
मक्का	खरीफ	उदयपुर, भीलवाड़ा, चित्तौड़गढ़
बाजरा	खरीफ	बाड़मेर, जयपुर, अलवर,
कपास	खरीफ	गंगानगर, हनुमानगढ़

28. Answer D

Solution:

Rajasthan is India's fourth-largest cotton-producing state.

कपास उत्पादन में राजस्थान भारत का चौथा सबसे बड़ा उत्पादक राज्य है

29. Answer D

Solution:

Product	Rajasthan's Rank in India	Contribution
Milk Production	2nd	14.51%
Wool Production	1st	47.53%

उत्पाद	भारत में राजस्थान का स्थान	योगदान
दुग्ध उत्पादन	2nd स्थान	14.51%
ऊन उत्पादन	1st स्थान	47.53%

30. Answer D

Solution:

Rajasthan's Rank According to the 20th Livestock Census, 2019

Animal	Rank in India	Note
Goat	1st	Rajasthan accounts for 14% of India's goat population.
Donkey	1st	Rajasthan accounts for 18.91% of India's donkey population.
Camel	1st	Rajasthan accounts for 84.43% of India's camel population—"The State of Camels."

20वीं पशुगणना 2019 के अनुसार राजस्थान का स्थान	
पशु	भारत में स्थान
बकरी	1st
गधा	1st
ऊंट	1st
Note	देश की 14% बकरियां राजस्थान में
	देश की 18.91% गधा
	देश की 84.43% ऊंट - "ऊंटों का राज्य"

31. Answer D

Solution:

Ber and Date Palm Research Centre

Location: Bikaner

Established: 1978

बेर एवं खजूर अनुसंधान केन्द्र स्थान: बीकानेर (स्थापना 1978 में)

32. Answer B

Solution:

Rajasthan produces approximately **94% of India's gypsum** and ranks **1st in gypsum production**.

Uranium is found in **Dungarpur, Banswara, and Ajmer** districts of Rajasthan.

राजस्थान, देश के लगभग 94% जिप्सम का उत्पादन करता है।

राजस्थान जिप्सम उत्पादन में 1st है।

राजस्थान के डूंगरपुर, बाँसवाड़ा और अजमेर में यूरेनियम पाया जाता है ।

33. Answer C

Solution:

Ferrous Metallic Minerals

1. Cobalt
2. Chromite
3. Titanium
4. Manganese
5. Nickel
6. Iron

लौह धात्विक खनिज

1. कोबाल्ट
2. क्रोमाइट
3. टाइटेनियम
4. मैगनीज
5. निकल
6. लोहा

34. Answer C

Solution:

Asbestos: This mineral is found in Rishabhdev (Kherwara) in Udaipur (the largest deposits), Deval and Piparda in Dungarpur, Sendra in Pali, Nathdwara and Deogarh in Rajsamand, Kotri, Arjunpura and Kanwalai in Ajmer, and in Bhilwara district.

It is used to manufacture cement, roofing sheets, pipes, etc. Rajasthan has the

amphibole variety of asbestos.

एस्बेस्टॉस : राजस्थान के उदयपुर के ऋषभदेव (खेरवाड़ा) (सर्वाधिक), डूंगरपुर के देवल एवं पीपरदा, पाली के सेन्द्रा, राजसमंद के नाथद्वारा एवं देवगढ़, अजमेर के कोटड़ी, अर्जुनपुरा एवं कंवलई व भीलवाड़ा जिलों में पाया जाने वाला यह खनिज सीमेण्ट, छत की चदरों, पाइप आदि बनाने के काम आता है। राजस्थान में एम्फीबॉल किस्म का एस्बेस्टॉस मिलता है।

35. Answer C

Solution:

Rajasthan's busiest highway is **National Highway 8 (new numbers: NH 48 and NH 58)**, along the route:

Delhi → Kotputli-Behrur → Jaipur → Ajmer → Beawar → Bhilwara → Udaipur → Chittorgarh → Dungarpur → Ahmedabad → Mumbai → Chennai.

राजस्थान का सबसे व्यस्ततम राजमार्ग राष्ट्रीय राजमार्ग संख्या 8 (New No.- 48, 58) (दिल्ली-कोटपूतली बहरोड़ - जयपुर-अजमेर - ब्यावर-भीलवाड़ा-उदयपुर-चित्तौड़गढ़- डूंगरपुर-अहमदाबाद-मुम्बई-चेन्नई) है

36. Answer C

Solution:

Irrigation Project	Districts	River(s)
Narmada Canal Irrigation Project	Barmer, Jalore	—
Nohar Irrigation Project	Hanumangarh, Churu	Ravi-Beas
Parvati Pick-up Project	Baran	Chambal
Jawai Project	Pali, Sirohi, Jalore, Jodhpur	—
Som-Kamla-Amba Irrigation Project	Dungarpur	Som

नर्मदा नहर सिंचाई परियोजना - बाड़मेर, जालौर नोहर सिंचाई परियोजना - हनुमानगढ़, चुरू (रावी-व्यास) 'पार्वती पिक-अप प्रोजेक्ट - बारां, (चम्बल नदी) -जवाई परियोजना - पाली, सिरौही, जालौर, जोधपुर सोम-कमला अम्बा सिंचाई - डूंगरपुर (सोम)

37. Answer C

Solution:

Chauka System: Managing water resources in areas with limited water availability.

चौका प्रणाली = पानी की कम उपलब्धता वाले क्षेत्रों में पानी के संसाधनों का प्रबंधन करना

38. Answer B

Solution:

Ram Jal Setu Project — Funding Ratio:

Centre : Rajasthan : Madhya Pradesh = **90 : 5 : 5**

The **Indira Gandhi Canal Project (IGNP)** has **7 lift canals and 9 branches** for irrigation.

- **Kanwar Sen Lift Canal:** Located in Bikaner and Ganganagar districts.
- **Tejaji Lift Canal:** Located only in Bikaner district.

रामजलसेतु परियोजना केंद्र: राजस्थान : मध्यप्रदेश = 90: 5: 5
IGNP पर सिंचाई के लिए 7 लिफ्ट और 9 शाखाएँ बनाई गई हैं।
कँवरसेन लिफ्ट नहर बीकानेर व गंगानगर जिले में है, तेजाजी
लिफ्ट नहर केवल बीकानेर जिले में है।

39. Answer A

Solution:

The **Gararda Augmented Drinking Water Project** is a drinking water scheme in **Bundi district**.

गरडा वृद्ध पेयजल परियोजना बूंदी जिले की पेयजल योजना है।

40. Answer C

Solution:

Chambal Multipurpose Project

First Stage:

1. Gandhi Sagar Dam – The largest dam in the project.
2. Kota Barrage – Used only for irrigation.

Second Stage:

Rana Pratap Sagar Dam – The largest dam in Rajasthan within the project.

Third Stage:

Jawahar Sagar Dam.

चंबल बहुउद्देशीय परियोजना –

प्रथम चरण:

1. गाँधी सागर बाँध – सबसे बड़ा
2. कोटा बैराज – केवल सिंचाई हेतु

द्वितीय चरण:

राणा प्रताप सागर - सबसे बड़ा राजस्थान का

तृतीय चरण:

जवाहर सागर बाँध

41. Answer C

Solution:

$$(p) = \frac{4\sigma_1}{d}$$

$$\sigma_1 = \frac{Pd}{4}$$

$$(p) = \frac{8\sigma_2}{d}, \sigma_2 = \frac{pd}{8}$$

$$\frac{Pd}{\frac{pd}{8}} = 2 : 1$$

42. Answer A

Solution:

According to Indian Standard IS: 5973-1970, the modified Class A evaporation pan (also

known as the ISI Standard Pan) features the following parameters:

Diameter: 1220 mm (1.22 meters)

Depth: 255 mm (25.5 cm)

43. Answer B

Solution:

Rheology is study of non-newtonian fluids, that is, the fluids which do not obey Newton's law of viscosity.

44. Answer B

Solution:

When the rainfall intensity is greater than the infiltration capacity ($i > f_p$), the soil absorbs water at its maximum possible limit, meaning the actual infiltration rate equals the infiltration capacity ($f = f_p$). The remaining excess water becomes surface runoff.

45. Answer B

Solution:

Centre of pressure,

$$h_{cp} = \bar{h} + \frac{I_g}{Ah}$$

As depth of immersion increases, $\bar{h}$ increases and

$$h_{cp} \approx \bar{h} \text{ for large immersion depth.}$$

46. Answer B

Solution:

Ephemeral streams: These streams flow only in direct response to immediate precipitation events (like intense rainfall or snowmelt). Their riverbed remains entirely above the groundwater table throughout the whole year, meaning they receive absolutely no base flow contribution from groundwater.

Intermittent streams: These streams flow during specific times of the year (such as rainy seasons) when the regional water table rises above the stream bed. They do receive base flow contributions during these wet periods.

Perennial streams: These streams flow continuously all year round. They are deeply connected to the groundwater network and receive a constant, significant base flow contribution to sustain them even during dry periods

47. Answer C
Solution:
 • **General Fluid Flow:** For any steady flow (whether rotational or irrotational), Bernoulli's equation can always be applied **along a single, specific streamline**.
 • **Rotational vs. Irrotational:** If the steady flow is *irrotational*, the Bernoulli constant remains the same throughout the entire flow field, meaning the equation can be applied between any two points in the fluid. However, if the flow is *rotational*, the constant changes from one streamline to another, restricting the equation's validity to **points lying on the same streamline**.
48. Answer B
Solution:
Meyer's formula is an empirical equation used to determine Evaporation losses

$$(E_L = k(e_w - e_a) \left(1 + \frac{u_0}{16}\right))$$
49. Answer D
Solution
 $a_1 v = a_2 v_2$
 $\frac{\pi}{4} d_1^2 v_1 = \frac{\pi}{4} \times \left(\frac{1}{2} d_1\right)^2 \times v_2$
 $\frac{\pi}{4} d_1^2 v_1 = \frac{\pi}{4} \times \frac{1}{4} d_1^2 \times v_2$
 $v_2 = 4v_1$
50. Answer C
Solution:
Momentum correction factor (β)
 (i) Laminar flow (β) = 1.33
 (ii) Turbulent flow (β) = 1.2
 Hence option (c) is correct.
51. Answer A
Solution:
Ice itself is a general state of matter and not classified as a distinct form of weather precipitation
52. Answer A
Solution:
Lifting warm air from the atmosphere (Convective Precipitation): This statement is

- correct. When the Earth's surface gets intensely heated by the sun, the air directly above it becomes warm, expands, and grows lighter. This warm air naturally rises vertically into the atmosphere. As it ascends, it cools and condenses to form cumiform clouds, which lead to convective (or convectional) precipitation
53. Answer A
Solution:
 $V_1 = 8 \text{ m/sec}$
 $V_2 = 6 \text{ m/sec}$
 $\rho = 1000 \text{ kg/m}^3$
 According to Bernoulli equation

$$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + z_2$$

$$(z_1 = z_2)$$

$$\frac{P_1 - P_2}{\rho g} = \frac{V_2^2 - V_1^2}{2g}$$

$$\Delta P = \frac{(8)^2 - (6)^2}{2} \times 1000$$

$$\Delta P = \frac{28 \times 1000}{2} = 14000 \text{ N / m}^2$$
54. Answer D
Solution:
 $u = 6xy - 2x^2$
 Using continuity equation

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$$

$$(6y - 4x) + \frac{\partial v}{\partial y} = 0$$

$$\partial v = (4x - 6y) dy$$
 on integrating, we get

$$v = 4xy - \frac{6y^2}{2} + f(x)$$

$$\Rightarrow v = 4xy - 3y^2 + f(x)$$
 Here $f(x)$ is the integration constant. It appears because any function of x alone vanishes when differentiated with respect to y . Since the questions gives no extra condition, we take $f(x) = 0$.

$$v = 4xy - 3y^2$$
 Hence option (d) is correct.

55. Answer D
Solution:
Aquitard : This is a partly permeable geological formation. It can hold a good amount of water but does not yield water freely to wells due to its lesser permeability. Water only seeps or flows very slowly through it, making the direct yield to a well insignificant

56. Answer C
Solution:
For distorted model of river.

$$Q = L_{rH} \cdot (L_{rv})^{3/2}$$

$$\Rightarrow \frac{Q_p}{Q_m} = \frac{L_{pH}}{L_{mH}} \cdot \left(\frac{L_{pv}}{L_{mv}} \right)^{3/2}$$

$$\frac{1500}{Q_m} = 150 \cdot (25)^{3/2}$$

$$\Rightarrow Q_m = 0.08 \text{ m}^3 / \text{sec}$$

57. Answer B
Solution:
With the reduction of unit hydrograph duration, 1 cm excess rainfall will occur in reduced period. So peak ordinate of UH will increase and the time base will decrease. Thus the peak ordinate of 2 hr UH will be greater than 80 m³/s.

58. Answer D
Solution

- Models for which one or more similarity requirements are not satisfied are called distorted models.
- Distortion of models is frequently adopted in problem involving rivers, spillways, and harbours, for example in river models, a different scale ratio for depth is adopted. Such models with vertical scales greater than horizontal scales are called vertically exaggerated models

59. Answer A
Solution:
IHP stands for 'international hydrological program'. The international program (IHP) is the only inter-governmental program of the United Nation devoted to water research, water reservoir management and education & capacity building. It was started in 1975.

60. Answer C

Solution:

Froude No : Related to Inertia Force and gravity force

Euler number: Related to Inertia force and pressure force.

Reynolds number: Related to Inertia force and viscous force

Mach number: Related to Inertia force and Elastic force.

61. Answer A

Solution:

$$(d) = 100 \text{ mm} = 0.1 \text{ m}$$

$$(H) = 5 \text{ m}$$

$$(C_d) = 0.8$$

$$Q = C_d a \sqrt{2gH}$$

$$Q = C_d \times \frac{\pi}{4} \times d^2 \times \sqrt{2gH}$$

$$Q = 0.8 \times \frac{\pi}{4} \times (0.1)^2 \times \sqrt{2 \times 10 \times 5}$$

$$Q = 0.02 \pi \text{ m}^3 / \text{s}$$

$$Q = 20 \pi \text{ litre} / \text{sec}$$

62. Answer C

Solution:

Recurrence interval or return period,

$$T = \frac{N+1}{m}$$

Probability of occurrence,

$$P = \frac{m}{N+1}$$

where, N = size of entires

M = Order no. or rank

63. Answer D

Solution

$$\frac{fQ^2}{12.1d^5} = h_L = 8 \text{ m}$$

$$\frac{0.02 \times 600 \times Q^2}{12.1 \times 0.3^5} = 8 \text{ m}$$

$$\Rightarrow Q = 0.14 \text{ m}^3 / \text{sec}$$

64. Answer A

Solution:

'Tipping bucket gauge' is a recording type rain gauge

'ISI standard pan' is used to measure evaporation loss

'Lysimeter' is used to measure actual evapotranspiration in the field.

'Rainfall simulator' is a device used to calculate infiltration capacity.

65. Answer B

Solution:

Water Hammer in Pipe –

(i) If the valve is closed slowly

$$T > \frac{2L}{C}$$

(ii) If the valve is closed suddenly

$$T < \frac{2L}{C}$$

$$T = 3.92 \text{ second}$$

$$C = 1500 \text{ m/sec}$$

$$L = 3 \text{ km}$$

$$\frac{2L}{C} = \frac{2 \times 3000 \text{ m}}{1500 \text{ m/sec}} = 4 \text{ sec}$$

$$\therefore T < \frac{2L}{C}$$

Therefore, the valve will close suddenly.

66. Answer C

Solution:

Since the pipes are connected in parallel, head loss will be same in both the pipes

$$\therefore \frac{fLQ^2}{12.1D^5} = C$$

$$\therefore Q^2 \propto D^5$$

$$\left(\frac{Q_1}{Q_2}\right) = \left(\frac{2D}{D}\right)^{5/2} = 5.66$$

67. Answer B

Solution:

- Increases stability (Statement 1): The metacentric height (GM) is a direct measure of the initial static stability of a floating vessel. A larger metacentric height means the ship has a greater restoring moment, making it highly stable and reducing the risk of capsizing.
- Decreases comfort for passengers (Statement 4): The time period of rolling oscillation (T) for a ship is inversely proportional to the square root of its metacentric height, calculated by the formula:

$$T = \frac{2\pi K}{\sqrt{g \cdot GM}}$$

68. Answer C

Solution:

In the Muskingum method of hydrologic river routing, the outflow at the end of a time step (I_2) is calculated using the following equation:

$$Q_2 = C_0 I_2 + C_1 I_1 + C_2 Q_1$$

For this equation to maintain continuity and mass balance, the routing coefficients must satisfy the fundamental relationship:

$$C_0 + C_1 + C_2 = 1$$

69. Answer C

Solution:

N = The time interval (in days) from the peak of the hydrograph to the point where surface runoff effectively ends on the recession limb.

A = The catchment or drainage basin area, which must be substituted explicitly in square kilometers (km^2)

70. Answer D

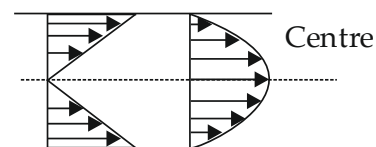
Solution:

Popularly the equation of discharge for the steady flow in a confined aquifer is called Theim's equation. Dupit's equation is the equation for steady flow in unconfined aquifer. Bernoulli's equation is based on energy conservation principle and the continuity equation is based on mass conservation principle. So the correct option is (d).

71. Answer B

Solution:

Shear stress and velocity profile in laminar pipe flow is as given below



Shear stress Velocity profile

$$V = V_{\max} \left(1 - \frac{r^2}{R^2} \right)$$

$$\tau = \frac{2\mu V_{\max}}{R^2} \times r$$

When $r = 0$, it means at centre of pipe

$$V = V_{\max}, \tau = 0$$

We know that

Discharge, $Q = \frac{\pi}{8\mu} \left(-\frac{dp}{dx} \right) R^4$

It means $Q \propto \frac{1}{\mu} \left[\text{Since } -\frac{dp}{dx} = \text{constant} \right]$

Statements (2) is wrong.

Also, $V_{av} = \frac{1}{32\mu} \left(-\frac{dp}{dx} \right) . D^2$

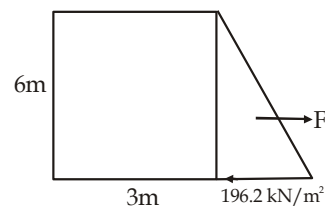
$-\frac{dp}{dx} = \text{Hydraulic gradient}$

$\Rightarrow \text{Hydraulic gradient} \propto V_{av}$

Hence, statement (4) is wrong.

72. Answer D

Solution:



Hydrostatic pressure force (f) = $\rho g A \bar{h}$

= $9.81 \times 103 \times 6 \times 3 \times 3 = 529.74 \times 103 \text{ N}$

total pr. force = $196.2 \times 103 \times 18 - 529.74 \times 103$

= $3.001 \times 106 \text{ N}$

73. Answer A

Solution:

Transmissivity, $T = kD$

Equivalent k in x- direction, $k_{eq} = \frac{\sum kD}{\sum D}$

Hence equivalent transmissivity = $\sum kD$

$k_{eq} (D_1 + D_2 + D_3) = \frac{\sum kd}{\sum D} (\sum D) = \sum kD$

= $(4 \times 30) + (2 \times 10) + (6 \times 20)$

= $120 + 20 + 120 = 260$

So the correct option is (a).

74. Answer A

Solution:

In laminar flow

Average velocity, $V_{avg} = \frac{1}{8\mu} \left(-\frac{dp}{dx} \right) R^2$

= $\frac{1}{8 \times 0.9} \times \left(\frac{1800 \times 10^3}{100} \right) \times (30 \times 10^{-3})^2$

= 2.25 m/s

75. Answer B

Solution:

Muskingum method of flood routing involves the concept of wedge and prism storage. The correct option is (b).

76. Answer C

Solution:

The relationship between coefficient of contraction, coefficient of velocity and coefficient of discharge is $C_d = C_v C_c$

77. Answer A

Solution:

(i) Standard project flood (SPF): This is the estimate of the flood likely to occur from the most severe combination of the meteorological and hydrological conditions, which are reasonably characteristic of the drainage basin being considered, but excluding extremely rare combination.

(ii) Maximum probable flood (MPF): This differs from the SPF in that it includes the extremely rare and catastrophic floods and is usually confined to spillway design of very high dams. The SPF is usually around 80% of the MPF for the basin.

(iii) Design flood: It is the flood adopted for the design of hydraulic structure like spillways, bridge openings, flood banks, etc. It may be the MPF or SPF or a flood of any desired recurrence interval depending upon the degree of flood protection to be offered and cost economics of construction of structures.

(iv) Maximum flood: Correspond to peak flow obtained from observed data.

78. Answer B

Solution:

A triangular notch gives much more accurate results in low discharge conditions as compared to convention rectangular notch.

79. Answer A

Solution:

$x = v_c \times t$

$y = \frac{1}{2} g t^2$

$$y = \frac{1}{2}g\left(\frac{x^2}{v_c^2}\right)$$

$$v_c = \sqrt{\frac{gx^2}{2y}} \quad \dots (i)$$

$$C_v = \left(\frac{v_c}{\sqrt{2gH}}\right) = \sqrt{\frac{gx^2}{(2y \cdot 2gH)}}$$

$$C_v = \sqrt{\frac{x^2}{4Hy}} = \left(\frac{x}{2\sqrt{Hy}}\right)$$

80. Answer A

Solution:

Shape of rising limb depends upon both storm and catchment characteristics whereas shape of falling limb depends only on catchment (storage) characteristics. Drainage density is the ratio of length of the stream to the area of catchment. Peak discharge is given by, $Q = ciA$. The correct option is (a).

81. Answer D

Solution:

$$\text{Chezy's coefficient } (c) = \sqrt{\frac{8g}{f}}$$

$$c \propto \frac{1}{\sqrt{f}}$$

82. Answer D

Solution:

Energy equation can be used to know the pressure at a point in a pipeline using Bernoulli's eq. which states that

$$\frac{p}{\rho g} + \frac{v^2}{2g} + z = \text{constant}$$

- Continuity equation is used to find out the flow at two sections of tapering pipes
 $Q = AV = \text{constant}$
- Impulse momentum principle is used to find out the force on a moving vane.
- Concept of moment of momentum (angular momentum principle is used in lawn sprinkler problems).

83. Answer A

Solution:

(a) In order to derive a Unit hydrograph from a flood hydrograph first of all base flow is separated from flood hydrograph to obtain the direct runoff hydrograph (surface runoff

hydrograph). Then surface runoff volume is computed which is equal to the area under direct runoff hydrograph. By dividing the surface runoff volume by the catchment area surface runoff depth is obtained. Now Unit hydrograph is obtained by dividing the surface runoff ordinates by surface runoff depth.

Note that if we neglect interflow (as its contribution is very less to direct runoff), direct runoff surface runoff.

So correct option is (a).

84. Answer A

Solution:

Type of channel	Non-scouring velocity (m/sec)
Earthen channels	0.6-1.2
Ordinary brick-lined channels	1.5-2.5
Cement concrete channels	2.5-3.0

85. Answer D

Solution:

$$\psi = (14.14y - 10x) \dots (i)$$

$$v = -\left(\frac{\partial \psi}{\partial x}\right) = +10$$

$$u = \left(\frac{\partial \psi}{\partial y}\right) = 14.14 = 10\sqrt{2}$$

velocity along x axis = 14.14 units

$$\vec{V} = 10\sqrt{2}\mathbf{i} + (10)\mathbf{j}$$

$$\therefore \tan \theta = \frac{10}{10\sqrt{2}} = \frac{1}{\sqrt{2}}$$

$$\theta = 35.26$$

$$|\vec{V}| = \sqrt{(10\sqrt{2})^2 + (10)^2} = 17.30 \text{ units}$$

86. Answer C

Solution:

As one moves from head of the canal to the field, the duty of the water increases.

Duty : It is the number of hectares of land irrigated for full growth of a given crop by a supply of 1 cumec of water continuously during the entire base period of that crop.

Duty of water changes from place to place, it will be maximum at the field and minimum at the head of the main canal.

Duty is the area that can be irrigated by the discharge of 1 cumec of water.

At the head of the canal, there are numerous losses to occur later which requires more amount of water to irrigate a particular field. However, if considered on the field, all losses have already occurred and a lesser amount of water is required to irrigate the same considered area.

87. Answer D

Solution:

$$\text{Runoff depth} = (6.2 - 1.2 \times 2) + (5 - 1.2 \times 2)$$

$$= 3.8 + 2.6 = 6.4 \text{ cm}$$

$$\therefore \text{Runoff volume} = 6.4 \times 10^{-2} \times 250$$

$$\times 10^6 \times 10^{-4} \text{ ha-m}$$

$$= 1600 \text{ ha-m}$$

88. Answer C

Solution:

The result from Thiessen polygon method is more accurate than arithmetic mean method. But there is no any close relationship between values obtained by Thiessen polygon method and Arithmetic mean method.

There is no any relation between P_A and P_T .

89. Answer B

Solution:

Resultant vertical force passes through the C.G of displaced liquid.

90. Answer A

Solution:

The ease of evaporation of liquid is related to the strength of attractive forces between the molecules in the liquid.

Rate of evaporation

$$\propto \frac{1}{\text{Intermolecular interaction in liquid}}$$

Order of intermolecular force among Benzene, Ethyl alcohol, Mercury, water is
Mercury > Water > Ethyl alcohol > Benzene
so, order of rate of evaporation in decreasing order will be.

Benzene > Ethyl alcohol > water > Mercury.

91. Answer B

Solution:

Hyetograph is a plot of the intensity of rainfall against time interval.

Direct runoff hydrograph is defined as the hydrograph of direct runoff resulting from rainfall excess occurring uniformly over the basin and at a uniform rate for a specified duration.

An isohyet is a line joining points of equal rainfall magnitude. Isohyetal method is used to calculate average rainfall depth over a catchment.

Mass curve is a plot of the cumulative rainfall against time. So, the correct option is (b).

92. Answer A

Solution:

$$P / \rho g = h$$

From the above equation,

It is clear that pressure head at any point in a liquid subjected to a constant horizontal acceleration is equal to the height of the liquid column above that point.

Therefore the pressure distribution in a liquid subjected to a constant horizontal acceleration is same as hydrostatic pressure distribution.

Planes of constant pressure are therefore, parallel to the inclined surface.

93. Answer C

Solution:

Assertion is correct because losses are less and efficiency high.

Sprinkler system causes interference in farming operation because of its network system.

$\therefore$ R is wrong.

94. Answer C

Solution:

Pressure is a scalar quantity. It has defined magnitude but undefined direction. Fluid thrust will always act perpendicular to the surface of contact in case of stationary fluid. It will not always act downward.

95. Answer A
Solution:
• Pelton wheel is pure impulse turbine
• Kaplan turbine is an axial flow turbine
• Priming is required in centrifugal pump
• Surging is required in centrifugal compressor

96. Answer D
Solution:
Calculate the net depth of water stored in the root zone (d_w):
Total water applied = 500 m^3
Loss due to evaporation and deep percolation = 10% of $500 \text{ m}^3 = 50 \text{ m}^3$
Net water stored in the soil = $500 - 50 = 450 \text{ m}^3$
Area of the plot = 1000 m^2
Depth of water stored (d_w) = $\frac{\text{Net water stored}}{\text{Area of plot}} = \frac{450 \text{ m}^3}{1000 \text{ m}^2} = 0.45 \text{ m}$
Relate depth of water to soil moisture capacity:
The formula linking depth of stored water to field capacity is:

$$d_w = \frac{\gamma_d}{\gamma_w} \times d \times (FC - w_i)$$

Substitute the values and solve for FC:

$$0.45 = \frac{15}{9.81} \times 2 \times (FC - 0.05)$$

$$0.45 = \frac{30}{9.81} \times (FC - 0.05)$$

$$FC - 0.05 = \frac{0.45 \times 9.81}{30}$$

$$FC - 0.05 = 0.015 \times 9.81$$

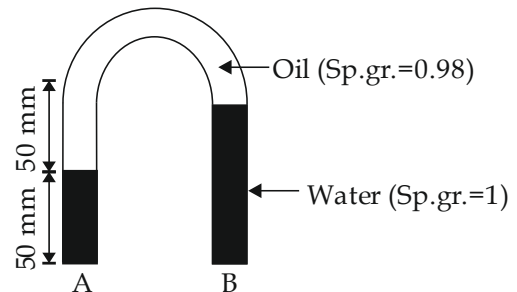
$$FC = 0.14715 + 0.05 = 0.19715 \approx 19.7\%$$

97. Answer D
Solution:
 $D = 8.64 \frac{B}{D} (\text{days}) / \text{hec} / \text{cumec}$
 $\frac{8.64}{100} = 8.64 \times \frac{10}{D}$
 $D = 1000 \text{ hec/cumec}$

98. Answer C
Solution:
Let gauge pressure be = P
 $\therefore P + (1.6\rho_w)g \times 0.7 + 13.6\rho_w g \times 0.25 - (13.6\rho_w g \times 0.7) = 0$
 $\therefore P = 5g\rho_w = 5 \times 10 \times 10^3$
 $= \frac{50000}{10^5} \text{ bar} = 0.5 \text{ bar}$

99. Answer B
Solution:
CIR = Water required for consumptive use of plant
NIR = CIR + Water for leaching
FIR = NIR + field losses
GIR = FIR + canal losses

100. Answer B
Solution:



Starting from point A.

$$P_A = 50 \times 10^{-3} \times g \times 10^3 + 50 \times 10^{-3}$$

$$\times g \times 0.98 \times 10^3 - 100 \times 10^{-3} \times g$$

$$\times 10^3 + P_B$$

$$\therefore P_A - P_B = (50 \text{ g} + 49 \text{ g} - 100 \text{ g})$$

$$= -10 \text{ N/m}^2 \text{ (} g = 10 \text{ m/sec}^2 \text{)}$$

101. Answer A
Solution:
Because of the wastage of water, the amount of land that can be irrigated with reduced quantity of water will get reduced.
As a result, duty of the water in given case will be less.
If the irrigation water is used economically, then the duty of water will improve, as the same quantity of water would be able to irrigate more area.

102. Answer B
Solution:
Leaching is the procedure to reclaim saline land, water requirement for this is calculated under irrigation water.
During designing the water drainage system i.e., sub surface drainage system. leaching water should be considered as it percolates vertically and will join the sub surface drains.

103. Answer B

Solution:

$$S = \frac{4k}{q}(b^2 - a^2)$$

$$50 = \frac{4 \times 10^{-5}(10.3^2 - 10^2)}{q}$$

$$q = 4.872 \times 10^{-6} \text{ m}^3/\text{s}$$

$$q = \frac{1}{100} \times \alpha \times (S \times 1)$$

$$q = \frac{100}{8.64 \times 10^4}$$

$$\alpha = 0.841 \text{ m} \cong 84 \text{ cm}$$

104. Answer C

Solution:

Newtonian fluid - Viscosity invariant with shear stress

Ideal fluid - Frictionless and incompressible

Thixotropic fluid - Viscosity increases at higher shear stress

Rheological fluid - Viscosity decreases at higher shear stress

105. Answer A

Solution:

Garret's diagram is a graphical representation to obtain canal design parameters based on

(1) Kennedy's theory

(2) Kutter's formula (Purpose: to save time and to avoid repetitive enormous calculations)

106. Answer B

Solution:

Non-uniform flow: Velocity changes with distance → **Correct**

Uniform flow: Flow in a channel bend → **Incorrect**. In a bend, velocity distribution and direction change along the channel, so the flow is generally **non-uniform**.

Steady flow: Velocity does not change with time → **Correct**

Tranquil flow: Froude number < 1 → **Correct**

107. Answer C

Solution:

The channel cross-section and the channel slope changes continuously due to erosion and deposition of sediments till the channel attains Final Regime.

108. Answer A

Solution:

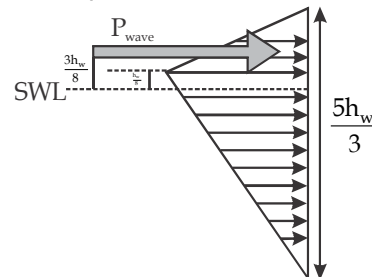
Generally width of launching apron is equal to 1.5D.

where D = scour depth below the original bed.

109. Answer A

Solution:

Wave pressure:



Max. wave pressure,

$$F = \frac{1}{2} \times \frac{5}{3} h_w \times 2.4 \gamma_w h_w$$

$$F = 2 \gamma_w h_w^2$$

This F force acts at a distance $\frac{3}{8} h_w$ above still water level.

110. Answer B

Solution:

Hydrostatic law - Rate of change of pressure in a vertical direction is proportional to specific weight of fluid

Newton's law - Shear stress is directly proportional to velocity gradient in fluid flow

Pascal's law - Pressure at a point is equal in all directions in a fluid at rest

Bernoulli's law - The total energy at a point is constant

111. Answer C

Solution:

The minimum base width of elementary profile can be obtained from following two criteria.

$$(i) B \geq \frac{H}{\mu(G-C)} \text{ (stability against sliding)}$$

$$(ii) B \geq \frac{H}{\sqrt{G-C}} \text{ (Stability against tensile failure)}$$

Where,

H = depth of water upstream

G = Specific weight of dam material

μ = Coefficient of friction

C = uplift coefficient

If uplift pressure is neglected i.e., C=0

$$B \geq \frac{H}{\mu G} \text{ and } \frac{H}{\sqrt{G}}$$

112. Answer D

Solution:

less than 2000 – Laminar flow

2000 to 4000 – Transition flow

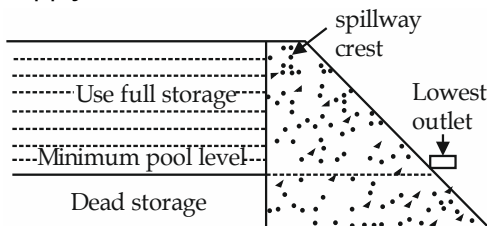
greater than 4000 – Turbulent flow

113. Answer B

Solution:

Live storage is the volume of water stored between normal pool level (which is equal to elevation of spill way crest) and minimum pool level (which is fixed at the elevation of lowest outlet)

The volume of water stored in reservoir below minimum pool level is known as dead storage. This storage does not used in the operations of reservoir like irrigation, hydropower and water supply.



Storage zone of reservoir

∴ Live storage = Water stored upto Full Reservoir Level (FRL)- Water stored upto lowest outlet

114. Answer C

Solution:

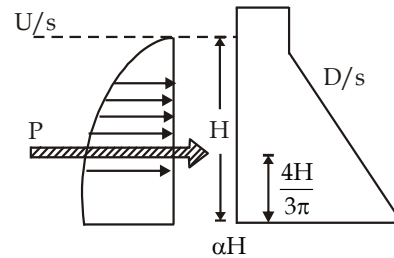
Statement S1 (True): Sudden expansion causes flow separation and violent eddy formation as the fluid expands into a larger area, resulting in a higher head loss. In contrast, sudden contraction causes a smoother acceleration of flow with lesser turbulence/loss

Statement S2 (False): The Total Energy Line (TEL or EGL) represents the total head $((P/\gamma + z + V^2/2g))$, while the Hydraulic Grade Line (HGL or HGL) represents the piezometric head $(P/\gamma + z)$. The energy line always lies above the hydraulic gradient line by the velocity head $(V^2/2g)$

115. Answer B

Solution:

Hydrodynamic pressure effect: It is the pressure force exerted by water on the dam due to seismic activities.



Von karman Equation

$$P = 0.555 K \cdot \gamma_w H^2 @ \frac{4H}{3\pi} \text{ above base}$$

116. Answer A

Solution:

for Incompressibility

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$$

Differentiating u with respect to x:

$$\frac{\partial u}{\partial x} = \frac{\partial}{\partial x} \left(\frac{y^3}{3} + 2x - x^2 y \right) = 2 - 2xy$$

Differentiating v with respect to y:

$$\frac{\partial v}{\partial y} = \frac{\partial}{\partial y} \left(xy^2 - 2y - \frac{x^3}{3} \right) = 2xy - 2$$

Adding these derivatives yields $(2 - 2xy) + (2xy - 2) = 0$, satisfying the continuity equation and confirming the **fluid is incompressible**

for Irrotationality

$$\omega_z = \frac{1}{2} \left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y} \right) = 0$$

$$\frac{\partial v}{\partial x} = y^2 - x^2$$

$$\frac{\partial u}{\partial y} = y^2 - x^2$$

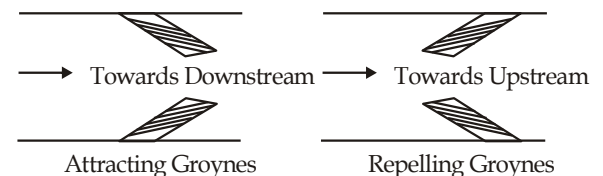
Since $\frac{\partial v}{\partial x} = \frac{\partial u}{\partial y}$, the rotation component is zero,

meaning the **flow is irrotational**

117. Answer A

Solution:

Spur is a rigid hydraulic structure made normal to the bank of river or canal to interrupts water flow along desired direction in order to protect the bank of river or canal.



Hence option (a) is correct.

118. Answer D

Solution:

In a closed hydraulic circuit (or loop), the law governing head loss is analogous to Kirchhoff's Voltage Law. It states that the **algebraic sum of the head losses** around any closed loop must equal zero $\sum h_f = 0$. Head loss is usually a function of flow rate and resistance (e.g., $h_f = rQ^n$). Directly adding the flow rate (flux) and the resistance factor mathematically does not equate to zero or represent a valid physical governing law.

119. Answer B

Solution:

Lacey's scour depth

$$= \left(\frac{q^2}{f} \right)^{1/3} \times 1.35 = \left(\frac{3^2}{1.2} \right)^{1/3} \times 1.35$$

$$= 2.64 \text{ m}$$

120. Answer A

Solution:

$$P_1 = 4.0 \text{ MPa}$$

$$P_2 = 4.5 \text{ MPa}$$

$$\rho = 600 \text{ kg/m}^3$$

$$\rho' = 602 \text{ kg/m}^3$$

$$d_p = P_2 - P_1 = 4.5 - 4 = 0.5 \text{ MPa}$$

$$d\rho = \rho' - \rho = 602 - 600 = 2 \text{ kg/m}^3$$

$$\text{bulk modulus (k)} = \frac{dp}{\frac{d\rho}{\rho}} = \frac{0.5}{2/600} = 150 \text{ MPa}$$

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