



**SSC JE
2019-20**

**Mechanical
Engineering**

Mega Mock Challenge
(Mar 27- Mar 28 2020)

**Questions &
Solutions**

1. In the following question, select the related word from the given alternatives.

Rabies : Dog :: Ebola : ?

A. Fish

B. Mosquito

C. Cat

D. Bats

Ans. D

Sol. Here, Rabies is related to Dog and Ebola is related to Bats.

Rabies virus is spread by infected Dogs, they are believed to be the carrier in nature.

Ebola virus is spread by infected Bats, fruits bats are believed to be the carrier in nature.

Hence, the correct option is D.

2. Select the word-pair in which the two words are related in the same way as the two words in the following word-pair.

Author : Book ::

A. Doctor : Hospital

B. Spider : Web

C. Mother : Son

D. Reptile : Crawl

Ans. B

Sol. The specific work of an author is to write a book. Similarly, the specific work of a spider is to spin the web (web structure created by spiders).

Hence, the correct option is B.

3. In the following question, select the related word from the given alternatives.

Mason : Plumb line :: ? : ?

A. Surgeon : Scalpel

B. Sculptor : Spade

C. Blacksmith : Forcep

D. Gardener : Saw

Ans. A

Sol. Plumb line is the reference line with plumb bob a kind of tool used by Mason for building purpose. Similarly, Scalpel is the tool or instrument used by a Surgeon for surgery. Thus the pair related to the given pair is Surgeon : Scalpel.

Hence, the correct option is A.

4. In the following question, select the related group of letters from the given alternatives.

ACED : AIYP :: BECA : ?

A. AIDY

B. DIYA

C. DYIA

D. YIAD

Ans. C

Sol. **Logic:** Each letter in the second letter cluster is the square of the first letter cluster.

A(1) → A(1)

C(3) → I(9)

E(5) → Y(25)

D(4) → P(16)

Similarly,

B(2) → D(4)

E(5) → Y(25)

C(3) → I(9)

A(1) → A(1)

So, (BECA : DYIA)

Hence, the correct option is C.

5. In the following question, select the related group of letters from the given alternatives.

CD : PQ :: GH : ?

A. RS

B. TU

C. UV

D. WX

Ans. B

Sol. There are 26 alphabets in English and if we assign numbers to each and every alphabet starting from 'A', 'B', 'C' etc., it will appear to be:

A=1, B=2, C=3, D=4..... likewise, till Z=26

So,

(3)C + 13 = P

(4)D + 13 = Q

Likewise,

(7)G + 13 = T

(8)H + 13 = U

Hence, the correct option is B.

6. In the following question, select the related group of letters from the given alternatives.

KOT : PJO :: FIR : ?

A. TMN

B. NKM

C. KDM

D. MNJ

Ans. C

Sol.

| | | | | | | | | | | | | | |
|----------------|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Alphabet | A | B | C | D | E | F | G | H | I | J | K | L | M |
| Position value | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Alphabet | Z | Y | X | W | V | U | T | S | R | Q | P | O | N |
| Position value | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 |

Here,

K + 5 = P

O - 5 = J

T - 5 = O

Likewise,
 $F + 5 = K$
 $I - 5 = D$
 $R - 5 = M$

Hence, the correct option is C.

7. In the following question, select the related number from the given alternatives.

$$16 : 27 :: 25 : ?$$

- A. 56
- B. 64
- C. 46
- D. 54

Ans. B

Sol. Here, $16 : 27$ may be written as $(4)^2 : (4-1)^3$

Similarly, the second pair is $(5)^2 : (5-1)^3 \rightarrow 25 : 64$

So, 64 is the required answer.

Hence, the correct option is B.

8. In the following question, select the related number from the given alternatives.

$$\frac{5}{3} : \frac{26}{16} :: \frac{7}{4} : ?$$

- A. $\frac{56}{16}$
- B. $\frac{36}{22}$
- C. $\frac{30}{21}$
- D. $\frac{36}{21}$

Ans. D

Sol. Here, $\frac{5}{3} : \frac{26}{16}$ may be represented as follows:

$$\frac{5}{3} : \frac{5 \times 5 + 1}{3 \times 5 + 1} \Rightarrow \frac{5}{3} : \frac{26}{16}$$

Similarly,

$$\Rightarrow \frac{7}{4} : \frac{7 \times 5 + 1}{4 \times 5 + 1} \Rightarrow \frac{7}{4} : \frac{36}{21}$$

Thus, $\frac{36}{21}$ is the required answer.

Hence, the correct option is D.

9. In the following question, select the related number from the given alternatives.

$$24 : 4 :: 72 : ?$$

- A. 8
- B. 5
- C. 6
- D. 9

Ans. A

Sol. Here, $24 : 4$ may be written as;

$$\Rightarrow 24 : \frac{24}{2+4} = \frac{24}{6} = 24 : 4$$

Similarly,

$$\Rightarrow 72 : \frac{72}{7+2} = \frac{72}{9} = 72 : 8$$

Thus, 8 is the required answer.

Hence, the correct option is A.

10. Three of the following four number-pairs are alike in a certain way and one is different. Find the odd one out.

A. 13 – 40

B. 18 – 55

C. 9 – 29

D. 17 – 52

Ans. C

Sol. The pattern is :

$$13 \times 3 + 1 = 40$$

$$18 \times 3 + 1 = 55$$

$$\mathbf{9 \times 3 + 1 = 27 \text{ and not } 29}$$

$$17 \times 3 + 1 = 52$$

Hence, the correct option is C.

11. In the following question, select the odd number pair from the given alternatives.

A. 58 : 29

B. 70 : 35

C. 86 : 43

D. 95 : 59

Ans. D

Sol. Except for option D that does not follow the above pattern, all other three follows the format of = $(2x : x)$.

$$\text{Like, } (58 : 29) \Leftarrow (2 \times 29 : 29)$$

Hence, the correct option is D.

12. In the following question, select the odd number from the given alternatives.

A. 953

B. 523

C. 312

D. 734

Ans. A

Sol. Except for option (A), all others follow the following logic: **First digit = sum of last two digits.**

$$\mathbf{A. 953; 9 = 5 + 3 = 8}$$

$$B. 523; 5 = 2 + 3 = 5$$

$$C. 312; 3 = 1 + 2 = 3$$

$$D. 734; 7 = 3 + 4 = 7$$

Hence, option A is the correct answer.

13. In the following question, select the odd letters from the given alternatives.

- A. AD
- B. HJ
- C. NP
- D. OQ

Ans. A

Sol. Except for AD, in all other pairs, the second letter is 2 steps ahead of the first letter. Hence, the correct option is A.

14. Three of the following four letter-clusters are alike in a certain way and one is different. Pick the odd one out.

- A. PXWQ
- B. SKLV
- C. BKJC
- D. FNMG

Ans. B

Sol. Except for SKLV, all other options have first and last letters in consecutive order according to the alphabetical order. Similarly, third and second letters in reverse order as per the alphabetical order.

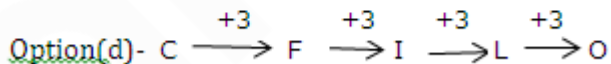
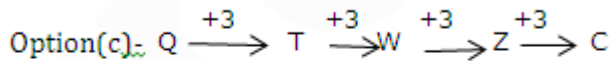
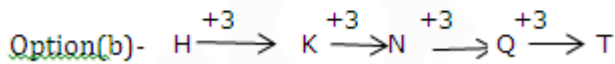
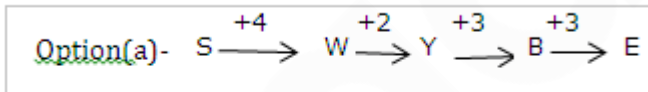
Hence, the correct option is B.

15. In the following four letter-group, three-letter group are related to one another in a certain way and one letter group is different from others. Find the different letter group.

- A. SWYBE
- B. HKNQT
- C. QTWZC
- D. CFILO

Ans. A

Sol.



Hence, the correct answer is option A.

16. In the following question, select the odd word from the given alternatives.

- A. Earthworm
- B. Mole
- C. Chipmunk
- D. Monkey

Ans. D

Sol. All except 'Monkey' lives underground burrows. However, monkeys prefer to live on trees and some on grounds.

Hence, the correct option is D.

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17. In the following question, select the odd word from the given alternatives.

- A. Lizard
- B. Snake
- C. Octopus
- D. Dog

Ans. D

Sol. Except for dog, all others are groups of animals that crawl.

Hence, the correct option is D.

18. In the following question, select the odd word from the given alternatives.

- A. Berlin
- B. Malé
- C. Kale
- D. Lisbon

Ans. C

Sol. Except for Kale (leaf cabbage), all others are the capital of a country.

Berlin is the capital of **Germany**.

Malé is the capital of the **Maldives**.

Lisbon is the capital of **Portugal**.

Hence, the correct option is C.

19. Which of the following options represents the logical and meaningful combination of the given words?

- 1. Karnataka
 - 2. Banglore
 - 3. Asia
 - 4. India
 - 5. World
- A. 1, 5, 4, 3, 2
 - B. 3, 4, 2, 1, 5
 - C. 2, 1, 4, 3, 5
 - D. 2, 3, 4, 1, 5

Ans. C

Sol. The correct order is-

- 2. Banglore
- 1. Karnataka
- 4. India
- 3. Asia
- 5. World

Correct order is (2, 1, 4, 3, 5).

Hence, the correct option is C.

20. Select the correct alternative to indicate the arrangement of the following words in a logical and meaningful order.

- 1. Compose
- 2. Content
- 3. Subjects
- 4. Gmail
- 5. Send
- 6. Recipients

A. 4, 1, 5, 3, 2, 6

B. 6, 1, 4, 3, 2, 5

C. 4, 2, 6, 3, 1, 5

D. 4, 1, 6, 3, 2, 5

Ans. D

Sol. The correct order to send a new email to someone by Gmail is-

4. Gmail

1. Compose

6. Recipients

3. Subjects

2. Content

5. Send

Correct order is (4, 1, 6, 3, 2, 5).

Hence, the correct option is D.

21. Arrange the following words in a logical and meaningful order.

1. Egypt

2. Africa

3. Great Pyramid

4. World

5. Giza

A. 3, 5, 2, 1, 4

B. 5, 3, 1, 2, 4

C. 3, 5, 1, 2, 4

D. 5, 3, 1, 4, 2

Ans. C

Sol. The Giza pyramid is the site on the Giza Plate in Egypt. Egypt is a country of Africa

Continent that is the world's second-largest continent.

So, the correct order will be;-

3. Great Pyramid

5. Giza

1. Egypt

2. Africa

4. World

Hence, the correct option is C.

22. In the following series, which letter-group will replace the question mark (?)

GXB, JVD, MTF, PRH, ?

A. SQJ

B. RPJ

C. RQI

D. SPJ

Ans. D

Sol. The pattern is :

$$G \xrightarrow{+3} J \xrightarrow{+3} M \xrightarrow{+3} P \xrightarrow{+3} S$$

$$X \xrightarrow{-2} V \xrightarrow{-2} T \xrightarrow{-2} R \xrightarrow{-2} P$$

$$B \xrightarrow{+2} D \xrightarrow{+2} F \xrightarrow{+2} H \xrightarrow{+2} J$$

Hence, the correct option is D.

23. Which letter will replace the question mark (?) in the following series?

W, Y, C, ?, I, K

- A. E
- B. B
- C. F
- D. O

Ans. A

Sol. Given series follows the pattern given below:

$$W \xrightarrow{+2} Y \xrightarrow{+4} C \xrightarrow{+2} E \xrightarrow{+4} I \xrightarrow{+2} K$$

Hence, the correct option is A.

24. Which letter-cluster will replace the question mark (?) in the following series.

PRT, TVX, ?, BDF, FHJ

- A. XZB
- B. YZB
- C. XAB
- D. XZC

Ans. A

Sol.

$$PRT \xrightarrow{+2+2} TCX \xrightarrow{+2+2} XZB \xrightarrow{+2+2} BDF \xrightarrow{+2+2} FHJ$$

There is a gap of two places in each letter of every letter cluster, and the next letter cluster is starting with the last alphabet of the previous letter cluster.

Hence, the correct option is A.

25. Which number will replace the question mark (?) in the following series?

4, 10, 18, 38, ?, 150

- A. 78
- B. 74
- C. 84
- D. 70

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Ans. B

Sol. Pattern is- (+2, -2, +2, -2, +2..)

$\Rightarrow 4 \times 2 + 2 = 8 + 2 = 10$

$\Rightarrow 10 \times 2 - 2 = 20 - 2 = 18$

$\Rightarrow 18 \times 2 + 2 = 36 + 2 = 38$

$\Rightarrow 38 \times 2 - 2 = 76 - 2 = \mathbf{74}$

$\Rightarrow 74 \times 2 + 2 = 148 + 2 = 150$

Hence, the correct option is B.

26. Which option will replace the question mark (?) in the following series?

0.15, 0.20, 0.30, 0.45, 0.65, ?

A. 0.90

B. 0.85

C. 0.80

D. 0.95

Ans. A

Sol. Logic-

$0.15 + 0.05 = 0.20$

$0.20 + 0.05 + 0.05 = 0.30$

$0.30 + 0.05 + 0.05 + 0.05 = 0.45$

$0.45 + 0.05 + 0.05 + 0.05 + 0.05 = 0.65$

$0.65 + 0.05 + 0.05 + 0.05 + 0.05 + 0.05 = 0.90$

Hence, the correct option is A.

27. A series is given with one term missing. Select the correct alternative from the given ones that will complete the series.

6, 22, 92, ?, 2788

A. 454

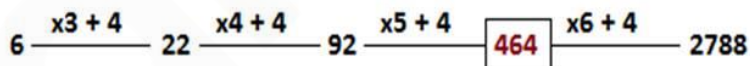
B. 468

C. 472

D. 464

Ans. D

Sol. The pattern is :



Hence, the correct option is D.

28. If 'A + B' means 'A is the father of B', 'A - B' means 'A is the mother of B', 'A * B' means 'A is the brother of B' and 'A % B' means 'A is the sister of B', then how is Q related to S in 'P + Q * R - S'?

A. Husband

B. Uncle

C. Brother

D. Father

Ans. B

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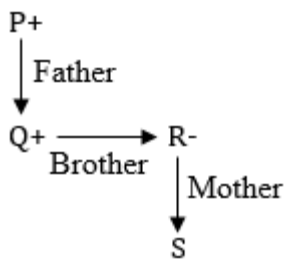
Sol.

| Symbol | Meaning |
|--------|---------|
| + | Father |
| - | Mother |
| * | Brother |
| % | Sister |

Given Relation: 'P + Q * R - S'

- ⇒ P is the father of Q,
- ⇒ Q is the brother of R,
- ⇒ R is the mother of S.

So,



Note: here (+) denotes male and (-) denotes female,

Clearly, Q is the maternal Uncle of S.

Hence, the correct option is B.

29. Among S, W, J, K and T each having different numbers of the books, K has more books than S and T and W has fewer books than T, S has more books than T and K has fewer books than J. Who among them is the second highest number of the books?

- A. K
- B. W
- C. J
- D. T

Ans. A

Sol. In this question, we show that – Among S, W, J, K and T each having different numbers of the books are given below,

(I). K has more books than S and T - $K > S, T$

(II). W has fewer books than T - $T > W$

(III). S has more books than T - $S > T$

(IV). K has fewer books than J - $J > K$

After observing I, II, III & IV statement we get: $J > K > S > T > W$

So, K has the second-highest number of books.

Hence, the correct option is A.

30. In the following question, select the word which cannot be formed using the letters of the given word.

DELBRUGECKIAI

- A. RACING
- B. DUKE
- C. BRIDE
- D. CABLE

Ans. A

Sol. Letter 'N' is not present in the word 'DELBRUGECKIAI'. Therefore, we cannot form the word 'RACING'.

Hence, the correct option is A.

31. In a code language, 'DEAR' is coded as '7465' and 'LIFE' is coded as '8394'. Then how 'IDEAL' will be coded in that language?

- A. 73648
- B. 37684
- C. 84673
- D. 37468

Ans. D

Sol. Take corresponding letter code-

| | | | |
|---|---|---|---|
| D | E | A | R |
| 7 | 4 | 6 | 5 |

and

| | | | |
|---|---|---|---|
| L | I | F | E |
| 8 | 3 | 9 | 4 |

Therefore,

| | | | | |
|---|---|---|---|---|
| I | D | E | A | L |
| 3 | 7 | 4 | 6 | 8 |

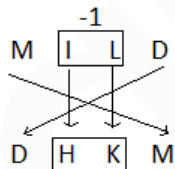
Hence, the correct option is D.

32. In a certain code language, MILD is written as DHKM, then what will be the code of SHIP ?

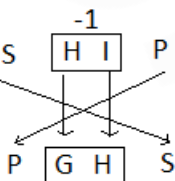
- A. HSRP
- B. HSPG
- C. PGHS
- D. PRHS

Ans. C

Sol. Pattern is:



Similarly,



So, the code for SHIP would be PGHS.

Hence, the correct option is C.

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33. Which of the following two signs need to be interchanged to make the given equation correct?

$$20 \div 6 - 30 + 4 \times 24 = 80$$

A. + and \div

B. \times and $-$

C. + and $-$

D. \div and \times

Ans. B

Sol. **By checking Option(A)-**

$$20 \div 6 - 30 + 4 \times 24 = 80$$

After interchanging-

$$20 + 6 - 30 \div 4 \times 24 = 80$$

Apply BODMAS,

$$20 + 6 - 30 \div 4 \times 24$$

$$= 20 + 6 - 180$$

$$= 26 - 180 = -154$$

Thus, $20 \div 6 - 30 + 4 \times 24 = 80$ is not the correct equation.

By checking Option(B)-

$$20 \div 6 - 30 + 4 \times 24 = 80$$

After interchanging-

$$20 \div 6 \times 30 + 4 - 24 = 80$$

Apply BODMAS,

$$20 \div 6 \times 30 + 4 - 24$$

$$= 100 + 4 - 24$$

$$= 104 - 24$$

$$= 80$$

Thus, $20 \div 6 - 30 + 4 \times 24 = 80$ is the correct equation.

As, we found the correct answer, so no need to check more options.

Hence, the correct answer is option B.

34. If 'ARUN' is coded as 54, then how will 'VARUN' be coded as?

A. 87

B. 67

C. 76

D. 78

Ans. C

Sol. As,

$$A + R + U + N = 1 + 18 + 21 + 14 = 54$$

Similarly,

$$V + A + R + U + N = 22 + 1 + 18 + 21 + 14 = 76$$

Hence, the correct option is C.

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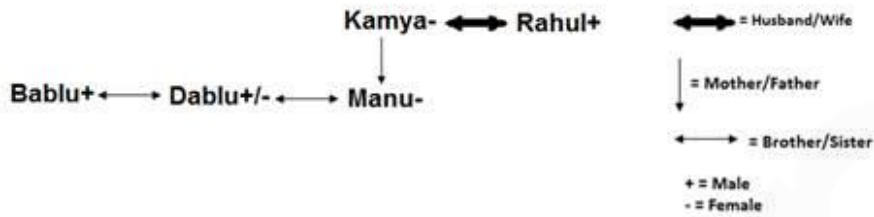
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35. Bablu is the brother of Dablu. Manu is the sister of Bablu. Kamyia is the mother of Manu. Rahul is the husband of Kamyia. How is Dablu related to Rahul?
 A. Daughter B. Son
 C. Son or Daughter D. Brother

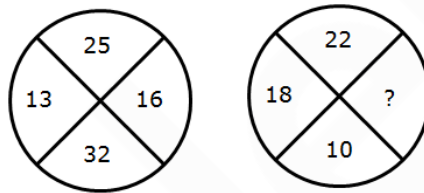
Ans. C

Sol. In this question, we show that -



Clearly, Dablu is the son or daughter of Rahul.
 Hence, the correct option is C.

36. In the following question, select the missing number from the given alternatives.



- A. 19 B. 10
 C. 14 D. 12

Ans. C

Sol. As,

$$25 + 13 + 32 = (2 + 5) + (1 + 3) + (3 + 2) = 7 + 4 + 5 = 16$$

Similarly,

$$22 + 18 + 10 = (2 + 2) + (1 + 8) + (1 + 0) = 4 + 9 + 1 = 14$$

Hence, the correct option is C.

37. Select the option which completes the following series:



- A. B.
 C. D.

Ans. D

Sol. After carefully observing the figures given in the question, it is very clear that the answer figure (D) will be the next figure.

Logic- no. of straight lines increasing by +1 with respect to the right end.



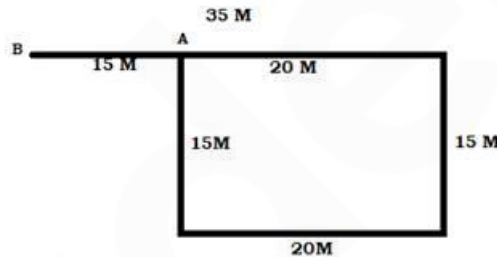
Hence, the correct option is D.

38. Abhishek started from a point. A and walked 15 meters towards the south. He turned left and walked 20 meters. He then turned left again and walked 15 meters. He again turned left and walked 35 meters and reached a point B. how far and in which direction is point B with respect to point 'A'?

- A. 15 meters, West
- B. 20 meters, North
- C. 35 meters, South
- D. 15 meters, East

Ans. A

Sol.



Here we can see that Abhishek is 15 meter for and in the west direction from point (A)

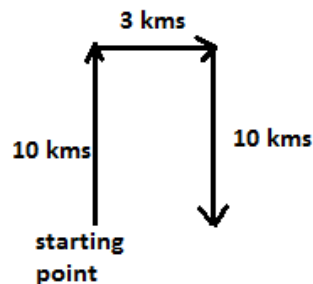
Hence, the correct option is A.

39. P starts from a point and walks 10 kms north and then turns right and walks 3 kms. Then again turns right and walks 10 kms. In which direction he is now from the starting point?

- A. North
- B. South
- C. East
- D. West

Ans. C

Sol.



Clearly, you can see that he is in east direction with respect to starting point.

Hence, the correct option is C.

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40. Two statements are given, followed by three conclusions numbered I, II and III. Assuming the statements to be true even if they seem to be at variance with commonly known facts, decide which of the conclusions logically follow(s) from the statements.

Statements:

All books are diaries.

All diaries are laptop.

Conclusions:

I) All books are laptops.

II) All laptops are books.

III) Some laptops are books.

A. Only I follow

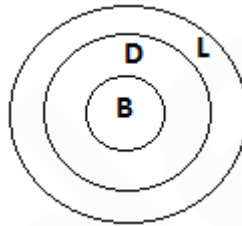
B. All follows

C. Only I and III follows

D. None follows

Ans. C

Sol. The least possible Venn-diagram is :



Conclusions:

I. All books are laptops – (true) it is a definite case.

II. All laptops are books – (false) it is not a definite case.

III. Some laptops are books – (true) it is a definite case.

So, both I and III follow.

Hence, option C is correct.

41. In the following question, some statements followed by some conclusions are given. Taking the given statements to be true even if they seem to be at variance from commonly known facts, read all the conclusions and then decide which of the given conclusions logically follows the given statements.

Statements:

Some boys are girls.

Only a few girls are student.

Conclusion:

I. Some boys are student.

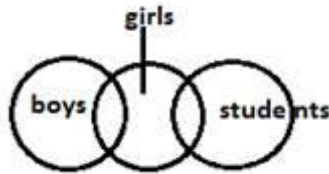
II. All boys are student is a possibility.

III. All girls are boys.

- A. Only conclusion I follow
- B. Either I or II follow
- C. Both I and II follows
- D. Only II follow

Ans. D

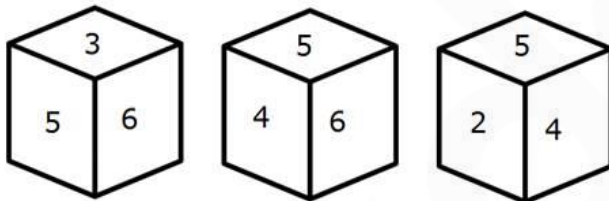
Sol. The least possible Venn diagram will be,



Conclusion:

- I. Some boys are student - (false) as there is no direct relation between them.
 - II. All boys are student is a possibility - (true) as the direct relation is not mentioned. So, it can be true.
 - III. All girls are boys. - (false) there may be a possibility but the given fact is definite. Hence, it is false
- Hence, the correct option is D.

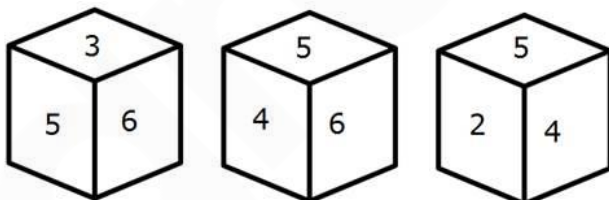
42. Three different positions of the same dice are shown. Which number will be at the top if 6 is at the bottom?



- A. 1
- B. 2
- C. 4
- D. 5

Ans. B

Sol.



From fig.(i) and fig.(iii), 5 is the common term.

Therefore, 3, 6, 4 and 2 will be the consecutive side face of 5, it means 1 will be the opposite of 5.

So, the opposite faces are:

5 is opposite of 1

3 is opposite of 4

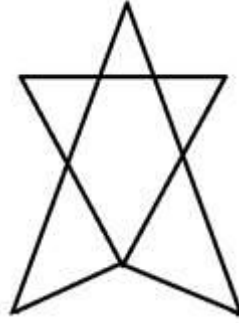
6 is opposite of 2

Hence, the correct option is B.

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43. Find the number of the triangle from the given figure?

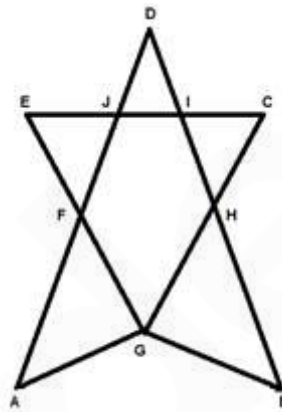


- A. 12
- C. 8

- B. 6
- D. 7

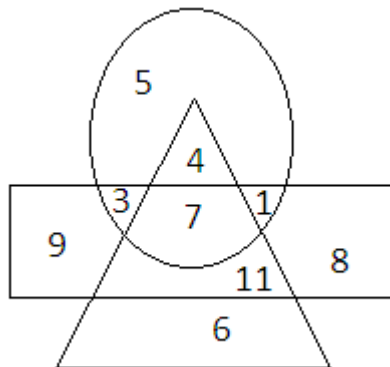
Ans. B

Sol.



This figure shows that the number of the triangle is AFG, BGH, CHI, DJI, EFJ, and GEC. The total number of 6 triangles is present. Hence, the correct option is B.

44. In the following diagram, the rectangle represents Jokers, the triangle represents dancers and the circle represents singers. The number in different segments show the number of persons.

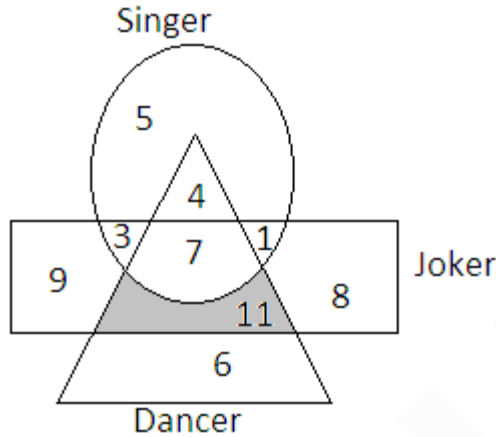


According to the given diagram, How many dancers are jokers but not singers?

- A. 11
- B. 15
- C. 7
- D. 4

Ans. A

Sol. The shaded part in the figure below represents the number of dancers who are jokers but not singers i.e. 11



So, the number of dancers who are jokers but not singers = 11

Hence, the correct option is A.

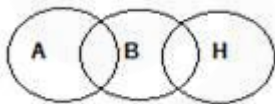
45. Select the Venn diagram that best illustrates the relationship among the following.

Ankle, Body, Heart

- A.
- B.
- C.
- D.

Ans. B

Sol. Ankle and heart both are the parts of the body but are different from each other.



Hence, the correct option is B.

46. In the question below, two statements are given, followed by two conclusions that may or may not follow. From the options below, choose the one that reflects the correct choice of conclusions that follow:

Statements:

- 1. Company X provides a cab service to its employees, which is why they are punctual to work.
- 2. Company Y does not provide cab service to its employees.

Conclusions:

- I. The employees of Company Y are not punctual to work.
- II. If Company X did not provide cab service, its employees might have not been as punctual to work as they currently are.

- A. Only I follows
- B. Only II follows
- C. Both I and II follow
- D. Neither I nor II follow

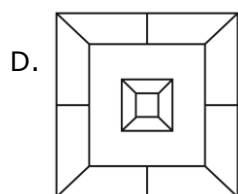
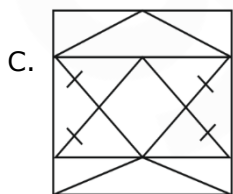
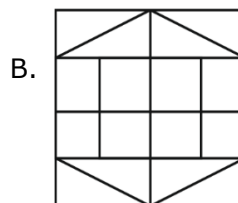
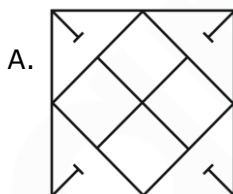
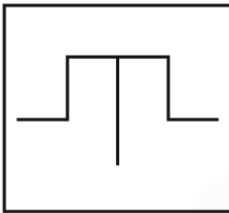
Ans. B

Sol. Conclusion I cannot be deduced as it is possible that there may be different factors that account for the punctuality of employees to work, so if Y does not provide cab service, we cannot say for sure that the employees are not punctual.

Conclusion II can be deduced as statement 2 directly attributes the reason for punctuality to the provision of a cab service by company X, so we can infer that if this provision weren't there, the employees of X may not have been as punctual.

Hence, the correct option is B.

47. From the given answer figures, select the one in which the question figure is hidden/embedded.



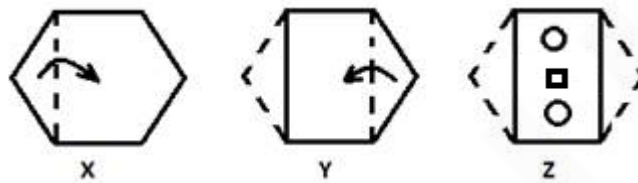
Ans. B

Sol. After carefully observing the figures given in the question, it is very clear that the question figure is embedded in the answer figure (B). It is shown as given below:



Hence, the correct option is B.

48. The sequence of folding a piece of square paper (figures X and Y) and the manner in which the folded paper has been cut (figure Z) are shown). How will the paper appear when unfolded?

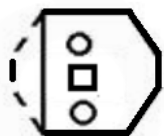


- A.
- B.
- C.
- D.

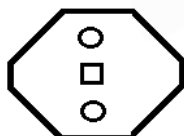
Ans. B

Sol. The paper is unfolded in two steps:-

Step 1 -

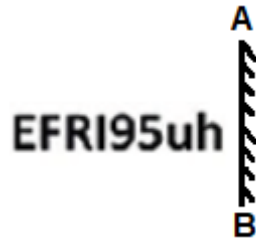


Step 2 -



Hence, the correct option is B.

49. If a mirror is placed on the line AB, then which of the answer figures is the right image of the given figure?



A.

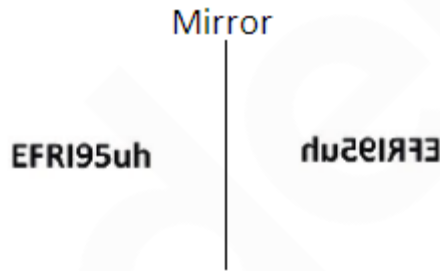
B.

C.

D.

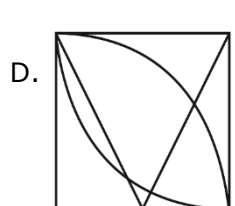
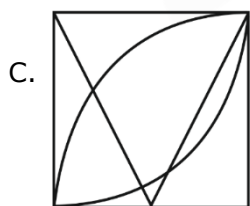
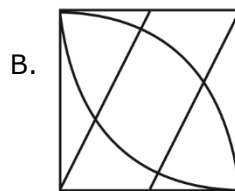
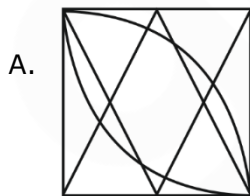
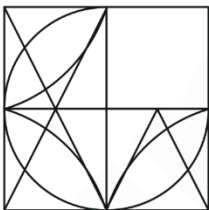
Ans. D

Sol. In a plane mirror, a mirror image is a reflected duplication of an object that appears almost identical, but it is reversed in the direction perpendicular to the mirror surface. As an optical effect, it results from the reflection of substances such as a mirror or water.



Hence, the correct option is D.

50. Which answer figure will complete the pattern in the question figure?



Ans. D

Sol.

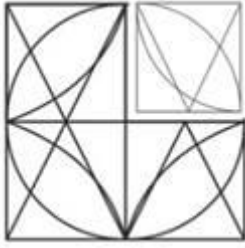


Figure in option D completes the pattern in the question figure.

Hence, the correct option is D.

51. Which layer of the earth has the lowest temperature?

- A. Crust
- B. Mantle
- C. Outer Core
- D. Inner Core

Ans. A

Sol. **Among the layers of the Earth, Crust has the lowest temperature.**

- Temperature rises with depth in the interior of earth.
- In the beginning, this rate of increase in temperature is at an average rate of 1°C for every 32 m increase in depth. However, it is not uniform in later stages.

52. The division of Bengal was adopted in _____.

- A. June, 1905
- B. Oct, 1905
- C. June, 1906
- D. Oct, 1906

Ans. B

Sol. **• The Partition of Bengal was announced in July, 1905 and it was implemented in Oct, 1905.**

- It was done during the time of Lord Curzon.
- Later in 1911 the partition of Bengal was repealed by King George.

53. Which one of them is correct with regards to GST?

- A. It is Direct tax.
- B. It is Indirect tax.
- C. GST was first implemented in China.
- D. None of these

Ans. B

Sol. **• Goods and Services Tax (GST) is an indirect tax or consumption tax.**

- It is imposed on the supply of goods and services.
- Petroleum products, alcoholic drinks, and electricity are not taxed under GST and instead are taxed separately by the individual state governments, as per the previous tax regime.

France was the first country to introduce this system in 1954.

54. Which of the following shortcut is used to insert a hyperlink?

- A. Ctrl+Z
- B. Ctrl+O
- C. Ctrl+K
- D. Ctrl+Y

Ans. C

Sol. • **Ctrl+K is used to Insert a hyperlink.**

- A hyperlink points to a whole document or to a specific element within a document.
- Hypertext is text with hyperlinks.
- The text that it is linked from, is called anchor text.
- Ctrl+Y shortcut is used to redo the last action.
- Ctrl+Z is a shortcut key most often used to undo.
- Ctrl+O is a shortcut key most often used to open a new document, page, URL, or other files.

55. Which of the following is the largest religious monument in the world?

- A. Boudhanath
- B. Mahabodhi Temple
- C. Angkor Wat
- D. Pyramid of Giza

Ans. C

Sol. * **Angkor Wat** is the largest religious monument in the world, which is a Hindu temple complex in Cambodia.

- * It is dedicated to Lord Vishnu. It is example of the classical style of Khmer architecture.
- * It was built by the Khmer King Suryavarman II in the period 1113–50.
- * It encloses an area of 162.6 hectare.

56. Who recently wrote the book Magadhnama?

- A. Kalraj Mishra
- B. Tamilsai Soundararajan
- C. Phagu Chauhan
- D. Kumar Nirmalendu

Ans. D

Sol. The book Magadhnama is recently written by **Kumar Niemalendu** and released by Phagu Chauhan on 19th January, 2020.

- Phagu Chauhan is presently **governor** of Bihar.
- The 447-page research book gives interesting narrative presentation of the **glorious history of Magadha**.
- This book contains information about the history of Magadha, Buddhist and Jain religions in Magadha, and the prosperity of development, arts and genres.

57. Which of the following Indo-Greek ruler invaded the Ganga-Yamuna doab?

- A. Antiochus II
- B. Demetrius I
- C. Apollodotus I
- D. Menander

Ans. D

- Sol. • The most famous Indo-Greek ruler was **Menander** (Milinda).
• He invaded the **Ganga Yamuna doab**.
• He had his capital at **Sakala** (modern Sialkot in Punjab).
• He was converted to **Buddhism by Nagasena**.

58. What is the capital of Laos?

- A. Hanoi
B. Vientiane
C. Naypyitaw
D. Taipae

Ans. B

Sol. • **The capital and largest city of Laos is Vientiane.**

- Laos is south Asians country and a member of ASEAN.
- Luang Prabang, Savannakhet, and Pakse are some of its other major cities.

59. Cuttack city is located on the banks of which river?

- A. Damodar
B. Musi
C. Hugli
D. Mahanadi

Ans. D

Sol. **Cuttack city is located on the banks of Mahanadi.**

- Mahanadi is a 900 kms long river originating from **Dandakaranya hills in Raipur District**.
- It is one of the **most-active silt-depositing** streams in the Indian subcontinent.
- The famous Hindu Pilgrimage site 'Puri' is located on it's mouth.
- It finally drains into Bay of Bengal.

60. Which union ministry will launch the new company incorporation form "Spice+?"

- A. Ministry of Corporate Affairs
B. Ministry of Finance
C. Ministry of Housing & Urban Affairs
D. Ministry of Food Processing Industries

Ans. A

Sol. • The **Ministry of Corporate Affairs** will launch the new company incorporation form "**Spice+**".

- This is a part of a comprehensive package to make life easier for someone starting a business.
- It will be launched on 15 February 2020.

61. Kalinga Stadium is located in which state of India?

- A. Meghalaya
B. Mizoram
C. Kerala
D. Odisha

Ans. D

Sol. * The Kalinga Stadium is located in **Bhubaneswar, Orissa**.

* It is a multi-purpose stadium.

* Its foundation stone was laid by former chief minister of Odisha **Late Biju Patnaik** in **1978**.

* It has facilities for athletics, soccer, field hockey, basketball, tennis, table tennis, volleyball, Wall climbing and swimming.

* It has capacity of 15,000 people.

62. Which of the following government entity will launch a digital payments index (DPI) by July 2020?

A. SEBI

B. Income Tax Department

C. RBI

D. Finance Ministry

Ans. C

Sol. • **The Reserve Bank of India (RBI) will launch a digital payments index (DPI) by July 2020.**

• This index will indicate the level of digitalization prevailing in the country.

• Digital Payments Index (DPI) will help the regulator and government to understand the adoption of digital payments in the country.

63. In which state of India, the biggest rural technical festival Antahpragnya 2020 was inaugurated?

A. Andhra Pradesh

B. Telangana

C. Tamil Nadu

D. Karnataka

Ans. B

Sol. • India's Biggest Rural Technical Festival titled Antahpragnya 2020 was inaugurated in the state of **Telangana** at Rajiv Gandhi University of Knowledge Technologies-Basar (RGUKT-Basar).

• The three-day technical festival was organised from January 31 to February 2, 2020, with the theme 'Spot and encourage rural tech innovators'.

64. Who among the following was the first to offer Individual Satyagraha?

A. Jawahar Lal Nehru

B. Gandhi Ji

C. Vinobha Bhave

D. Sardar Patel

Ans. C

Sol. **Vinobha Bhave** is the first to offer Individual Satyagrah.

* The main aim behind launching individual satyagrah was to show the nationalist patience was not due to weakness and to enhance freedom of expression.

* The individual satyagrah started in 1940, and **JL Nehru was the second** person to offer the satyagrah.

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65. On mixing with water, Plaster of Paris sets to form _____.
- A. Calcium Carbonate B. Gypsum
C. Carbon Monoxide D. Phosphorous and Sulphurous gasses

Ans. B

Sol. • **Plaster of Paris produces Gypsum on adding water to it.**

- It is produced by heating gypsum at high temperature.
- It is used to:
 - A. make sculptures
 - B. decorate houses
 - C. protect broken bones
 - D. dentists have long used it for casting patients' teeth.
- Gypsum is raw material for Plaster of Paris, it is a soft sulphate material composed of Calcium Sulfate Dihydrate.
- It is used as a fertilizer, chalk etc.

66. Which of the following is a major pigment of bile?
- A. Rhodopsin B. Melanin
C. Hemoglobin D. Bilirubin

Ans. D

Sol. • **Bilirubin is a brownish-yellow pigment found in bile.**

- It is produced when the liver breaks down old red blood cells. Bilirubin is then removed from the body through the stool and gives stool its normal color.
- Bile is a yellowish-brown fluid, produced by the liver, that aids the digestion of lipids in the small intestine. It is stored and concentrated in the gallbladder.

67. Who discovered Ozone layer?
- A. Louis Pasteur B. Charles Fabry
C. William Faraday D. Robert Angus Smith

Ans. B

Sol. • The ozone layer was discovered in 1913 by the French physicists **Charles Fabry.**

- Ozone layer presents in our atmosphere that absorbs most of the Sun's ultraviolet radiation.
- The "Dobson unit" is a convenient measure of the amount of ozone.

68. Poonam Yadav received Arjun Award in 2019, she belongs to which sports?
- A. Cricket B. Badminton
C. Boxing D. Para Athlete

Ans. A

Sol. **Poonam Yadav** belongs to Cricket.

- She made her debut in 2013 in T20 against Bangladesh.

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- In October 2018, she was named in India's squad for the 2018 ICC Women's World Twenty20 tournament in the West Indies.
- She was awarded **Arjun Award** by President Ramnath Kovind on the occasion of National Sports Day that is 29 August, **2019**.

69. The DNA fingerprinting was given by _____.

- A. Robert Brown
- B. Alec Jeffrey
- C. Richard Altmann
- D. Carl Benda

Ans. B

Sol. DNA Fingerprinting was invented in 1984 by **Sir Alec Jeffreys**.

- DNA fingerprinting is a molecular genetic method that enables the identification of individuals using hair, blood, or other biological fluids or samples.
- DNA fingerprinting is useful in criminal identification, resolve maternity disputes, forensic wildlife etc.
- DNA is the **basic building block** of life. This component in cells contains all the information about an organism and it also helps transfer the characteristics to the next generation.

70. Lord Dalhousie served as Governor general of India from 1848 to _____.

- A. 1853
- B. 1854
- C. 1855
- D. 1856

Ans. D

Sol. * Lord Dalhousie served as Governor General of India from **1848 to 1856**.

- * His real name was James Andrew Ramsay.
- * During his tenure, First railway line between Bombay and Thane was built first PWD was set up and Widow remarriage act was passed.

71. National Horticulture Fair 2020 was held in_____.

- A. Lucknow
- B. Bhopal
- C. Bengaluru
- D. Mumbai

Ans. C

Sol. • The National Horticultural Fair-2020 was held in Bengaluru, Karnataka from 5-7th February, 2020.

- It was inaugurated by Dr. Trilochan Mohapatra, Secretary (DARE) and Director General (ICAR) on 5 February 2020.
- The "ICAR-IIHR Seed Portal" was launched during the festival.
- Over 10,000 farmers and other stakeholders participated in the fair.

72. Where is the headquarters of Comprehensive Nuclear Test Ban Treaty Organisation located?

- A. Vienna, Austria
- B. Rome, Italy
- C. Geneva, Switzerland
- D. Washington DC, US

Ans. A

Sol. * The Comprehensive Nuclear-Test-Ban Treaty (CTBT) organisation is headquartered in **Vienna, Austria**.

* The Comprehensive Nuclear-Test-Ban Treaty (CTBT) bans nuclear explosions by everyone, everywhere: on the Earth's surface, in the atmosphere, underwater and underground.

* It was founded in **1996**.

73. The air bubble in water shines due to which of the following phenomena?

- A. Dispersion
- B. Total internal reflection
- C. Reflection
- D. Polarisation

Ans. B

Sol. • The air bubble in water shines due to **the phenomenon of total internal reflection**.

• In this phenomenon, the light travels from a medium of greater refractive index to the lesser one. While doing this, the light gets internally reflected.

• The phenomenon of total internal reflection of light is used in many optical instruments like telescopes, microscopes, binoculars, etc. The brilliance of a diamond is due to total internal reflection.

74. Khoya PayaWeb Portal is related to?

- A. Exchange information about missing and found luggage in Railways
- B. Exchange information about missing and found of Children
- C. Exchange information about missing and found of Cell Phones
- D. Exchange information about missing and found of NRIs

Ans. B

Sol. Khoya PayaWeb Portal is related to exchange **information about missing and found of Children**.

• It has been developed by the **Ministry of Women and Child Development** and the Department of Electronics and Information Technology (**DeitY**).

• There is also portal named '**Track Child**' that belongs to the Ministry of **Home Affairs**.

• It was launched by former union minister Maneka Gandhi and Ravi shaker Prasad jointly in 2015.

75. Which of the following is not a scalar quantity?

- A. Distance
- B. Mass
- C. Temperature
- D. Force

Ans. D

Sol. **Force** is a vector quantity as this has both magnitude and direction.

• A scalar quantity is a physical quantity that only has magnitude and not direction. For example- Distance, Mass, Temperature etc.

• A vector quantity has both direction and magnitude like force, Velocity, acceleration etc.

76. Which is sweetest artificial sugar?

- A. Glucose
- B. Fructose
- C. Aspartame
- D. Sucralose

Ans. C

Sol. • Aspartame is an *artificial sweetener*.

- It is around 200 times sweeter than sucrose (table sugar).
- It is a methyl ester of the dipeptide of the natural amino acids L-aspartic acid and L-phenylalanine.

77. Arrange the following in the chronological order of their tenure:

- 1) Lord Curzon
 - 2) Lord Harding
 - 3) Lord Chelmsford
 - 4) Lord Irwin
- A. 1 2 3 4 B. 2 4 1 3
C. 1 4 2 3 D. 2 3 1 4

Ans. A

Sol. • The time period of all the given four Governors-General is-

1. Lord Curzon – 1899-1905
2. Lord Harding – 1910-1916
3. Lord Chelmsford- 1916-1921
4. Lord Irwin- 1926-1931

78. Which country is the highest emitter of Carbon dioxide in the world?

- A. Inida
- B. Usa
- C. China
- D. Russia

Ans. C

Sol. • **China is the highest emitter of Carbon Dioxide in the world with an annual CO2 emission of 9.8 Billion metric tons as of 2017-18.**

- About 70% of the total energy derived in China comes from coal alone which is the major source of carbon emission.
- **USA** is the second highest CO2 emitter in the world with annual carbon emission of 5.3 billion tons of carbon dioxide.
- **India** is the third largest carbon dioxide emitter with annual Carbon dioxide emission of 2.5 billion metric tons.

79. Who advises the Governor on matters pertaining to the welfare and advancement of the Scheduled Tribes in the State?

- A. Chief Minister
- B. Chief Justice of High Court
- C. National Commission for Scheduled Castes
- D. Tribal Advisory Council

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Ans. D

Sol. • **Tribal Advisory Council (TAC)** advises the Governor on matters pertaining to the welfare and advancement of the Scheduled Tribes in the State.

To take care of the welfare of the scheduled tribes, a Tribal Advisory Council is constituted in each State with a Scheduled Area.

This Tribal Advisory Council will be made of maximum 20 members out of which the three-fourth will be Scheduled Tribes MLAs in the State.

80. What happens to the magnetic field if the compass is moved away from the copper wire but the current through the wire remains the same?

- A. Decreases
- B. Increases
- C. First decreases than constant
- D. First increase than constant

Ans. A

Sol. When the compass is moved away from the copper wire but the current through the wire remains the same, the **Magnetic field decreases**.

- It is **because the** magnetic field is stronger near the wire and it decreases with increases in distance from it.
- In a straight current carrying wire, the magnetic field lines formed as **concentric circles** around it.

81. Which cell organelle is the site of ribosome synthesis?

- A. Golgi bodies
- B. Mitochondria
- C. Nucleolus
- D. Endoplasmic Reticulum

Ans. C

Sol. **Nucleolus is the site of ribosome synthesis.**

- Nucleolus is a round body shaped organelle found **inside the nucleus**.
- Nucleolus makes ribosomal subunits from proteins and rRNA, and sends them to rest of the cell to form complete ribosomes.
- It is also involved in controlling cellular activities and cellular reproduction.
- Ribosomes make proteins; therefore, the nucleolus plays a vital role in making proteins in the cell.

82. When acid and base are mixed in a test tube, it's temperature.....?

- A. Increases
- B. Decrease
- C. Remain constant
- D. Increase or decrease depend upon on concentration of acid and base

Ans. A

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Sol. When acid and base are mixed in a test tube, its **temperature increases**.

- It is because, when acid and base are mixed they form salts and this is an **exothermic** process releasing heat, hence increasing temperature.
- The heat released is sometimes known as **heat of neutralization**.
- Example of this type of reaction is – $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{heat}\uparrow$

83. The 1917 session of congress is presided by which of the following leaders?

- A. Sarojini Naidu
- B. Annie Besant
- C. Motilal Nehru
- D. CR Das

Ans. B

Sol. * In August 1917, **Annie Besant** was made the **President of the Calcutta Session** of the Indian National Congress.

- * Annie besant became the **first woman president of INC**.
- * Sarojini naidu became first Indian woman to become president of INC in 1925 at Kanpur Session.

84. Which is the highest peak in the state of Sikkim?

- A. Mt. Kanchenjunga
- B. Mt. Nanda Devi
- C. Mt. Abu
- D. Mt. Everest

Ans. A

Sol. **Mt. Kanchenjunga is the highest peak in Sikkim.**

- Kanchenjunga peak is 8586 meters high. It is the **highest peak of India** and third highest peak of the world.
- K2 or Godwin Austen is the second highest peak of the world and is in Karakoram range in Pak-occupied Kashmir region.
- Kanchenjunga is also known as the '**five treasures of snow**'.

85. Ease of living index (EoLI) and Municipal Performance Index (MPI) 2019 was launched by_____.

- A. Ministry of Corporate Affairs
- B. Ministry of Women and Child Development
- C. Ministry of Food Processing Industries
- D. Ministry of Housing & Urban Affairs

Ans. D

Sol. • Ease of living index (EoLI) and Municipal Performance Index (MPI) 2019 was launched by the **Ministry of Housing & Urban Affairs**.

- These indices are designed to assess quality of life of citizens in 100 Smart Cities and 14 other Million Plus Cities.

86. Who is the present chairman of SBI Bank?

- A. Rajnish Kumar
B. Rajeev Kumar
C. Ajay Tyagi
D. Shaktikanta Das

Ans. A

Sol. * **Rajnish Kumar** is the present chairman of **State Bank of India.**

* **Shaktikanta Das** the present chairman of **RBI.**

* **Ajay Tyagi** is the present chairman of **SEBI.**

* The Headquarters of all SBI, RBI and SEBI are present in **Mumbai.**

87. Ashok kumar Mehta Committee was related to which field?

- A. Sports
B. Panchayati Raj
C. Health
D. Sanitation

Ans. B

Sol. • Ashok Mehta Committee was related to Panchayati Raj System in India & it was formed in 1977 by Janata Government and it submitted its report in August 1978.

- It recommended two Tier Panchayati Raj System. It also recommended that a district should be the first point for decentralisation under popular supervision below the state level. Zila Parishad should be the executive body, there should be an official participation of political parties etc.

88. Which of the following layer of earth's surface reflects Long radio waves ?

- A. Stratosphere
B. Ionosphere
C. Tropopause
D. Troposphere

Ans. B

Sol. • Ionosphere reflects long radio waves.

- The ionosphere is a region of earth's upper atmosphere from about 65 km to 400 km altitude.
- It is ionized by solar radiation.
- It influences radio propagation to distant places on earth.

89. Which is the smallest state in India in terms of area?

- A. Sikkim
B. Goa
C. Manipur
D. Mizoram

Ans. B

Sol. **Goa is the smallest state of India in terms of area.**

- Rajasthan is the largest state of India in terms of area.
- Goa has an area of 3702 km sq. and contributes to .11% of total area of country.
- Rajasthan has an area of 342239 sq. kms and contributes to 10.41% of total area of country.
- India is the 7th largest country of the world by area. India accounts for 2.4 percent of total world surface area.

90. RESIDEX is released by_____.
- | | |
|-------------------------------|--------------------------|
| A. Reserve Bank of India | B. National Housing Bank |
| C. Ministry of urban planning | D. Ministry of Finance |

Ans. B

Sol. **National Housing Bank** releases the RESIDEX Index.

- This Index aims to track housing price indicators across Indian cities.
- National Housing Bank is a subsidiary of Reserve Bank of India established in **1988**.
- NHB registers, regulates and supervises Housing Finance Companies.
- RESIDEX was **first** started in **2007 and** currently offers two sets of quarterly Housing Price Indices across the cities it tracks.

91. Who won the Oscar award for best director in 2020?
- | | |
|-------------------|--------------------|
| A. Alejandro | B. Damien Chazelle |
| C. Alfonso Cuaron | D. Boon Joon Ho |

Ans. D

Sol. • **Boon Joon Ho** won the **Best director** Oscar award 2020 for the movie **Parasite**.

- Alfonso Cuaron won the best director Oscar award in 2019.
- The first Best director was awarded in 1929.

92. The World Patient Safety Day is observed on_____.
- | | |
|-------------------|-------------------|
| A. 15th September | B. 29th August |
| C. 21st September | D. 17th September |

Ans. D

Sol. • The World Health Organization (WHO) has declared **September 17th** (2019), as the first World Patient Safety Day.

- Globally, 134 million adverse events contribute to 2.6 million deaths each year due to unsafe care.
- The purpose of World Patient Safety Day is to promote patient safety by increasing public awareness and engagement, enhancing global understanding and working towards global solidarity and action.
- The World Health Organization is a specialized agency of the United Nations that is concerned with international public health.
- It was established on **7 April 1948**.
- It is headquartered in **Geneva, Switzerland**.

93. Which acid is present in Coconut oil?
- | | |
|----------------|----------------|
| A. Tamric Acid | B. Formic Acid |
| C. Lauric acid | D. Citric acid |

Ans. C

- Sol. • **Lauric acid is present in coconut oil.**
- It is also present in human breast milk.
 - Coconut oil is made up of a mixture of saturated, monounsaturated and polyunsaturated fats.
 - Lauric acid is a saturated fatty acid of 12 carbon atom chain.

94. Soorya festival is celebrated in which state of India?
- A. Maharashtra B. Karnataka
C. Jharkhand D. Kerala

Ans. D

- Sol. * Soorya festival is one of the biggest art and cultural event **in Kerala.** From 1977, it is annually celebrated in Thiruvananthapuram city.
- * It features film festivals, theater festivals, dance, music, painting and photography exhibitions etc.

95. Which of the following is a video capturing device?
- A. Webcam B. Monitor
C. Scanner D. Microphone

Ans. A

- Sol. * **A webcam** is a small digital video camera directly or indirectly connected to a computer or a computer network.
- * Webcams are capable of taking pictures as well as high-definition videos.
- * It is a video capturing device.
- * It is an input device because it captures a video image of the scene in front of it.

96. What is the name of ancient Hindu tradition in which a widow is allowed to have child with the husband’s brother?
- A. Niyoga B. Sethi
C. Shaka D. Vyapti

Ans. A

- Sol. **Niyoga** was the ancient Hindu tradition in which a widow is allowed to have child with the husband’s brother.
- As per the tradition the child so born is solely taken by widow and the male counterpart has no right on child.
 - For practising Niyoga, either a female is a widow or the couple is incapable of having any child.
 - Examples of Niyoga found in **Mahabharata.**

97. In February 2020, Who was appointed as MD and CEO of Dhanlaxmi Bank?
- A. Mahesh Kant B. Ravindra Rastogi
C. Sunil Gurbaxani D. S. Lakshmikant

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Ans. C

Sol. • In February 2020, **Sunil Gurbaxani** was appointed as Managing Director and CEO of Dhanlaxmi Bank.

- Prior to this appointment, he was working with **Axis Bank**.
- He will serve for a period of **three years** from the date of taking charge.
- Dhanlaxmi Bank was established in **1927**.
- It is headquartered in **Thrissur, Kerala**.

98. Which country will help India in Gaganyaan Mission?

- A. USA
- B. Canada
- C. Russia
- D. China

Ans. C

Sol. • Russia is the country which will help India in Gaganyaan Mission.

- Russia is today a world leader in space program and technology.
- The name of the Russian Space Agency is **ROSCOSMOS**, headquarters are in Moscow and The current [director](#) is [Dmitry Rogozin](#).

99. Formation of new states and alteration of areas & boundaries comes under which article of the Constitution of India?

- A. Article 4
- B. Article 2
- C. Article 3
- D. Article 5

Ans. C

Sol. • **Under Article 3**, the Constitution empowers Parliament to form a new State by separation of territory from any State or by uniting two or more States or parts of States or by uniting any territory to a part of any State.

- The Constitution further states that Parliament has the power to increase or diminish the area of any State or to alter the boundaries or names of any State.
- For example State of Bombay was bifurcated in Gujarat and Maharashtra on May 1, 1960. In January 2007 Uttaranchal was renamed to Uttarakhand.

100. Which of the following is not included in Executive power of President?

- A. Appointment of CAG
- B. Appointment of chairman of UPSC
- C. Making rules for more convenient transactions of business of Union government
- D. Disqualification based on Anti Defection Law

Ans. D

Sol. • **The executive power of President include-**

- a) Appointment of CAG.
- b) Appointment of UTs administrators.
- c) Appointment of chairman of UPSC, appoint a commission to investigate into the conditions of ST, SCs and other backward classes.
- d) Making rules for more convenient transactions of business of Union government.

• **While power to disqualify a member of Parliament or State Legislature under Anti Defection Law is inherited in chairperson of that house. So, Option D is correct Answer.**

101. Which of the following is internally fired boiler?

- A. Lancashire boiler
- B. Benson boiler
- C. Velcon boiler
- D. Cochran boiler

Ans A

Sol. In externally fired boilers, the furnace is located outside the boiler shell. In this the furnace is arranged underneath in brick work setting.

Water tube boilers are always externally fired boiler.

The examples of water tube boilers are: La-Mont boiler, Benson boiler, Stirling boiler, Babcock and Wilcox boiler, Yarrow boiler and Loeffler boiler.

102. The centre of pressure of surface subject to fluid pressure is the point.

- A. On the surface at which resultant pressure acts
- B. On the surface at which gravitational force acts
- C. At which all hydraulic forces meet
- D. Similar to meta centre

Ans. A

Sol. Centre of pressure is defined as the point of application of the total pressure force on the surface.

point of center of pressure is always below center of gravity.

103. A cylindrical pressure vessel is filled with a fluid at pressure of 150MPa. Also, the vessel is subjected to an external pressure of 50MPa. If the diameter of the vessel is 200mm, calculate the safe thickness of the vessel provided permissible stress is 400MPa.

- A. 20mm
- B. 25mm
- C. 30mm
- D. 35mm

Ans. B

Sol. Net pressure, $p = 150 - 50 = 100$ MPa

Hoop stress in cylinder = $pd/2t$

$$300 = (100) \times 200/2t$$

$$t = 100 \times 100/400$$

$$= 25\text{mm}$$

104. In a two rotor system, if moment of inertia of the rotors are I_1 and I_2 ($I_1 < I_2$) then, a node of vibration is situated

- A. between I_1 and I_2 but nearer to I_1
- B. between I_1 and I_2 but nearer to I_2
- C. exactly in the middle of the shaft
- D. nearer to I_1 but outside

Ans. B

Sol. Node of vibration is situated closer to the rotor containing high moment of inertia.

105. In velocity compounding, steam is passed through _____.
- A. fixed nozzle-moving blades-fixed blades-moving blades
 - B. fixed nozzle-moving blades-fixed nozzles-moving blades
 - C. moving blades-fixed nozzles- fixed blades-moving blades
 - D. fixed blades-moving blades-fixed nozzles- moving blades

Ans. A

Sol. **Compounding of Turbines:**

- Compounding of steam turbines is the method in which energy from the steam is extracted in a number of stages rather than a single stage in a turbine.
- A velocity-compounded impulse stage consist of a row of fixed nozzles followed by two or more rows of moving blades and fixed blades (without expansion) respectively.

106. Match List I with List II and select the correct option.

List-1

List-II

- A. Toughness
- B. Endurance strength
- C. Resistance to abrasion
- D. Deflection in a beam

- 1. Moment area method
- 2. Hardness
- 3. Energy absorbed before fracture in a tension test
- 4. Fatigue loading

- A. A-4, B-3, C-1, D-2
- C. A-3, B-4, C-2, D-1

- B. A-4, B-3, C-2, D-1
- D. A-3, B-4, C-1, D-2

Ans. C

Sol. Toughness is measured as energy absorbed before fracture in the tension test. Endurance strength is the strength against fatigue loading. Resistance to abrasion is called hardness. Deflection in beams is determined using moment area method.

107. What is the relationship between elastic constants E, G and K?

A. $E = \frac{KG}{9K + G}$

B. $E = \frac{9KG}{K + G}$

C. $E = \frac{9KG}{KG + 3G}$

D. $E = \frac{9KG}{3K + G}$

Ans. D

Sol. $E = 2G(1 + \mu)$... (i)

$E = 3k(1 - 2\mu)$... (ii)

Solving (i) and (ii)

$$\frac{E}{2G} - 1 = \left(1 - \frac{E}{3k}\right) \frac{1}{2}$$

$$\frac{E}{2G} - 1 = \frac{1}{2} - \frac{E}{6k}$$

$$E \left(\frac{1}{2G} + \frac{1}{6k} \right) = \frac{3}{2}$$

$$E \left(\frac{3k + G}{6kG} \right) = \frac{3}{2} = \frac{9kG}{3k + G}$$

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108. A torsion is applied on a shaft at its one end whereas the other end is fixed. then, Shear stress induced by torsion at circumference and at centre respectively will be,

A. Zero. Zero

B. Maximum, Maximum

C. Maximum, zero

D. Zero, maximum

Ans. D

Sol. From the torsion equation,

$$\frac{T}{J} = \frac{T}{r} = \frac{G\theta}{L}$$

From above equation.

$$T \propto r$$

at center, $r = 0$, thus shear stress will be zero.

at circumference, $r = r_{\max}$ thus shear stress will be maximum.

109. In Vickers hardness test method, the shape of indenter is

A. Square

B. Diamond

C. Hemisphere

D. Any of the above three

Ans. B

Sol. In Vickers hardness test loads using a diamond shape indenter to make an indentation in the form of a right pyramid with a square base and an angle of 136 degrees between opposite faces.

110. Which of the following is correct about the reheat cycle?

A. The optimum reheat pressure for most of the modern power plant is 0.2 to 0.25 of the initial steam pressure.

B. Reduction in the size of the boiler for the same power.

C. Reduction in moisture content.

D. All of the above

Ans. D

Sol. All of the given statement is true about reheat cycle.

So, the correct option is (d)

111. Which of the following material has highest thermal conductivity?

A. Silver

B. Copper

C. Diamond

D. Gold

Ans. C

Sol. $K_{\text{silver}} = 405 \text{ W/mK}$

$$K_{\text{copper}} = 385 \text{ W/mK}$$

$$K_{\text{diamond}} = 2300 \text{ W/mK}$$

$$K_{\text{gold}} = 319 \text{ W/mk}$$

So, the correct option is (c).

112. Which one of the following is the process to refine the grains of metal after it has been distorted by hammering or cold working?
- A. Annealing
 - B. Softening
 - C. Recrystallizing
 - D. Normalizing

Ans. A

Sol. Annealing eliminates all internal stresses, reduces hardness, increases ductility, enhances machinability, refines grain structure.

113. A shaft has a dimension $\Phi 25_{-0.030}^{-0.008}$ The respective value of fundamental deviation and tolerance are
- A. -0.03, ± 0.008
 - B. -0.008, 0.022
 - C. 0.03, ± 0.022
 - D. 0.008, 0.022

Ans. B

Sol. Fundamental deviation = limit of the part which closest to basic size = -0.008
Tolerance = upper limit - lower limit = 0.03-0.008 = 0.022

114. Circumferential and longitudinal strain in cylindrical boiler under internal steam pressure are ϵ_1 and ϵ_2 respectively, Change in volume of the boiler cylinder per unit volume will be
- A. $2\epsilon_1 + \epsilon_2$
 - B. $\epsilon_1 + 0.5\epsilon_2$
 - C. $\epsilon_1 + 2\epsilon_2$
 - D. $0.5\epsilon_1 + \epsilon_2$

Ans. A

Sol. Volume of cylinder, $V = \frac{\pi}{4} d^2 l$

$$\frac{\Delta V}{V} = 2 \frac{\Delta d}{d} + \frac{\Delta l}{l}$$

$$\epsilon_v = 2\epsilon_1 + \epsilon_2$$

Volumetric strain = 2 x Circumferential strain + Longitudinal strain

115. The combustion in a compression ignition engine is _____.
- A. heterogeneous
 - B. homogeneous
 - C. laminar
 - D. turbulent

Ans. A

Sol. The combustion in CI engine is heterogeneous because the air-fuel ratio is different at different-2 locations of the CI engine cylinder.

116. A fan consumes 50 W of electric power and has an air discharge of 0.25 kg/s, the maximum air outlet velocity is close to
- A. 200 m/s
 - B. 2000 m/s
 - C. 40 m/s
 - D. 20 m/s

Ans. D

Sol. given,

$$P = 50W$$

$$\text{Power} = \frac{1}{2} mv^2$$

$$\text{Therefore, } 50 = \frac{1}{2} \times 0.25 \times v^2,$$

$$v = 20 \text{ m/s}$$

117. According to Boyle's Law, constant temperature process is _____.

- A. Isothermal process
- B. Hyperbolic process
- C. Both A & B
- D. ISOMETRIC PROCESS

Ans. C

Sol. ○ Constant temperature process is known as isothermal process and hyperbolic process.

118. _____ is commonly used for making household utensils.

- A. Duralumin
- B. Hindalium
- C. Y-alloy
- D. Magnalium

Ans. D

Sol. Magnalium is commonly used for making household utensils. It contains aluminium alloy with 5% magnesium and 95% aluminum.

119. Density of water is maximum at

- A. 0°C
- B. 0°K
- C. 4°C
- D. 100°C

Ans. C

Sol. As temperature rises to over 4° C, the extra space needed by increased motion of water molecules starts being larger than the space gained due to structural changes and the molecules start to move away from each other due to which the Volume again increases and Density decreases. Thus, Density maximum is reached at 4°C.

120. The pressure distribution in the uniform wear theory is _____.

- A. directly proportional to radius
- B. directly proportional to the square of radius
- C. inversely proportional to radius
- D. inversely proportional to the square of radius

Ans. C

Sol. Uniform wear theory:

$$Pr = C$$

P is inversely proportion to radius.

121. What are the dimensions of kinematic viscosity of a fluid?

- A. $L T^2$
- B. $L^2 T^{-1}$
- C. $M L^{-1} T^{-1}$
- D. $M L^{-2} T^{-2}$

Ans. B

Sol. The SI unit of kinematic viscosity is square meter per second (m^2/s) means $L^2 T^{-1}$

Correct option is B

126. The particle moving with SHM, its maximum acceleration takes place, when
- A. it passes through its extreme position
 - B. it has maximum velocity
 - C. it passes through its mid position
 - D. none of the above

Ans. A

Sol. In case of SHM acceleration of the particle is maximum at its extreme position and also at that point velocity of the particle is zero.

127. The boiling point of ammonia is _____.
- A. -10.5°C
 - B. -30°C
 - C. -33.3°C
 - D. -77.7°C

Ans. C

Sol. • In refrigeration systems, the liquid is stored in closed containers under pressure. The boiling point of Ammonia is -33.3°C .

• The Boiling point of other most common refrigerant R12 is -29.8°C .

128. During a psychometric process, the latent heat added is 20 kJ/s and the sensible heat added is 30 kJ/s. Determine the Sensible heat factor:
- A. 0.3
 - B. 0.6
 - C. 0.6777
 - D. 1.5

Ans. B

Sol. By definition, Sensible heat factor = $\frac{\text{Sensible Heat}}{\text{Total Heat}}$

$$\text{Therefore, S.H.F} = \frac{\text{S.H}}{\text{S.H.} + \text{L.H.}} = \frac{30}{20 + 30} = \frac{3}{5} = 0.6$$

129. Which one of the following is not true about the orthogonal cutting?
- A. Cutting edge of the tool is perpendicular to the direction of cutting velocity.
 - B. The cutting edge is smaller than the workpiece width.
 - C. The cutting forces act along two directions only
 - D. None of these

Ans. B

Sol. In orthogonal cutting, the cutting edge is wider than the workpiece width and extends beyond the workpiece on either side. Also the width of the workpiece is much greater than the depth of cut.

So, the option (B) is not true about orthogonal cutting.

130. Indicator diagram of a reciprocating pump is a graph between
- A. flow vs swept volume
 - B. pressure in cylinder vs swept volume
 - C. flow vs speed
 - D. pressure vs speed

Ans. B

Sol. Indicator diagram of a centrifugal pump is defined as graph between pressure cylinder and swept volume. Pressure in y-axis and swept volume in x axis.

131. The property of bearing material which has the ability to accommodate small particles of grit, dust, etc. without much scoring and wearing of journal material is called:

- A. bondability
- B. conformability
- C. fatigue strength
- D. embeddability

Ans. D

Sol. Embeddability is the vital property for a bearing material to accommodate small particles of grit, dust, etc. without much scoring and wearing of journal material.

132. For what purpose Scotch yoke mechanism is used

- A. To generate sine functions
- B. To generate square roots
- C. To generate logarithms
- D. To generate inversions

Ans. A

Sol. In Scotch Yoke mechanism, the constant rotation of the crank produces harmonic translation of the yoke. Its four binary links are:

1. Fixed link
2. Crank
3. Sliding Block
4. Yoke.

133. The time by which activity completion time can be delayed without affecting the start of succeeding activities, is known as

- A. duration
- B. total float
- C. free float
- D. interfering float.

Ans. C

Sol. The time by which activity completion time can be delayed without affecting the start of succeeding activities, is known as free float

134. The total angular movement (in degrees) of a lead-screw with a pitch of 5.0 mm to drive the work-table by a distance of 200 mm in a NC machine is

- A. 14400
- B. 28800
- C. 70000
- D. 120000

Ans. A

Sol. Given,

pitch of screw = 5.0 mm i.e. in one rotation axial distance covered by table is 5mm

required work-table movement = 200 mm

so number of rotation required = $200/5 = 40$

angular movement in 1 rotation = 360°

so in 40 rotation = $40 \times 360^\circ = 14400$

135. Rotary compressors are used where _____ quantities of gas are needed at relatively _____ pressure.

- A. large, high
- B. large, low
- C. small, high
- D. small, low

Ans. B

Sol. Rotary compressors are used where large quantities of gas are needed at relatively low pressure.

136. For an ideal gas, the slope of the constant volume line is _____ than that of constant pressure line on the T-s diagram.

- A. Less
- B. Equal
- C. More
- D. Cannot be determined.

Ans. C

Sol. For an ideal gas:

$$\left(\frac{\partial T}{\partial S}\right)_v = \frac{T}{C_v}$$

$$\left(\frac{\partial T}{\partial S}\right)_p = \frac{T}{C_p}$$

Since $C_p > C_v$

$$\left(\frac{\partial T}{\partial S}\right)_v > \left(\frac{\partial T}{\partial S}\right)_p \text{ is always true for an ideal gas.}$$

137. When the motion between two pair is limited to a definite direction, irrespective of the direction of force applied, it is known as

- A. completely constrained motion
- B. incompletely constrained motion
- C. successfully constrained motion
- D. none of the above

Ans. A

Sol. When the motion between a pair is limited to a definite direction irrespective of the direction of force applied, then the motion is said to be a completely constrained motion.

138. The path traced by a fluid particle over a period of time is

- A. Flow line
- B. Path line
- C. Stream line
- D. Streak line

Ans. B

Sol. Path line is the path traced by fluid particle over a given period of time.

Stream line (also known as flow line) is one whose tangent at any point gives the velocity of flow at that point.

Streak line is the locus of different particles passed through a particular point at a particular time.

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139. Multi-cylinders engine gives

- A. uniform torque
- B. more unbalanced force
- C. need large flywheel
- D. all of the mentioned

Ans. A

Sol. Multi-cylinders need smaller flywheel and give uniform torque.

Unbalanced force is also less as compare to multi cylinder engine

140. A person who weighs 600 N steps onto a scale that is on the floor of an elevator. If the elevator accelerates downwards at a rate of 6 m/s^2 , the scale will read (take $g=10 \text{ m/s}^2$)

- A. 360 N
- B. 240 N
- C. 600 N
- D. 120 N

Ans. B

Sol. initial reading, $mg = 600\text{N}$,

$$m = 600/10 = 60\text{kg}$$

If the elevator accelerates downwards at a rate of 6 m/s^2 ,

then net acceleration, $g' = 10 - 6 = 4\text{m/s}^2$

$$a_{\text{net}}=4 \text{ m/s}^2,$$

therefore, the scale will read= $mg' = 60 \times 4=240 \text{ N}$

141. Choose the correct statements with respect to the distinction between an IC engine and a gas turbine .

- i. An IC engine has a lower mechanical efficiency than a gas turbine.
- ii. A flywheel is not needed for a gas turbine while it compulsory for an IC engine.
- iii. The thermal efficiency of a gas turbine is higher than an IC engine.
- iv. Starting of a gas turbine is difficult than an IC engine.

- A. (i) and (ii)
- B. (i), (ii) and (iv)
- C. (ii) and (iv)
- D. All of the above

Ans. B

Sol. An IC engine has a lower mechanical efficiency than a gas turbine due to large number of sliding parts in an IC engine.

A gas turbine does not need a flywheel as the torque on the shaft is continuous and uniform.

The thermal efficiency of a gas turbine is lower than an IC engine and it is difficult to start a gas turbine than an IC engine.

142. A cylinder with volume 6m^3 is floating in water with $2/3$ of the cylinder is inside water. Calculate the weight of the cylinder.

A. 58.860 kN

B. 39.24 kN

C. 19.62 kN

D. 392.4 kN

Ans. B

Sol. For floating body,

Weight of the body = Force of buoyancy

$$= \rho_{\text{water}} g V_{\text{submerged}}$$

$$= 1000 \times 9.81 \times \frac{2}{3} \times V_{\text{cylinder}}$$

$$= 1000 \times 9.81 \times \frac{2}{3} \times 6$$

$$= 39.24 \text{ kN}$$

143. The Independent variables in orthotropic materials are

A. 2

B. 21

C. 9

D. 3

Ans. C

Sol. In orthotropic materials, the independent variables are 9

In isotropic materials, the independent variables are 2

In anisotropic materials, the independent variables are 27

144. The following is the preliminary stage of Production planning

A. Capacity planning

B. Material requirements planning

C. Scheduling

D. Product development and design

Ans. D

Sol. Product development and design is the preliminary stage of Production planning

145. During machining when 3-2-1 principle is used to locate and support three dimensional workpiece, the number of degree of freedom that are not restricted is?

A. 6

B. 3

C. 9

D. 12

Ans. B

Sol. 3, in 3-2-1 principle out of 12 degree of freedom 9 are restricted so 3 are free

146. Hot chamber die casting is suitable for

A. high melting point alloys

B. low melting point alloys

C. both low and high melting alloys

D. heavy ferrous metals only

Ans. B

Sol. Hot chamber die casting is suitable for low melting point alloys, such as Zn, Sn, Pb.

147. A Carnot heat pump works between temperature limits of 277°C and 27°C. Its COP is

- A. 1.108
- B. 1.2
- C. 2.2
- D. 9.26

Ans. C

Sol. COP of heat pump is given by:

$$(\text{COP})_{\text{H.P.}} = \frac{T_H}{T_H - T_L}$$
$$(\text{COP})_{\text{H.P.}} = \frac{550}{550 - 300}$$
$$= 2.20$$

148. A diesel engine having compression ratio 19 and cutoff ratio 2.8. Find the percentage of working stroke at which heat is supplied.

- A. 5%
- B. 8%
- C. 10%
- D. Insufficient data

Ans. C

Sol. Percentage of working stroke = $\{(V_3 - V_2)/V_3\} \times 100$

$$= \{(V_3 - V_2)/(V_1 - V_2)\} \times 100$$
$$= [\{(V_3/V_2) - 1\} / \{(V_1/V_2) - 1\}] \times 100$$
$$= \{(r - 1)/(r - 1)\} \times 100$$
$$= \{(2.8 - 1)/(19 - 1)\} \times 100$$
$$= 10 \%$$

149. Rolling operation is performed from a roller having roll diameter 20mm, if the coefficient of friction is $\mu = 0.2$, the maximum draft will be (in mm)

- A. 0.1 mm
- B. 0.2 mm
- C. 0.4 mm
- D. 2 mm

Ans. C

Sol. given,

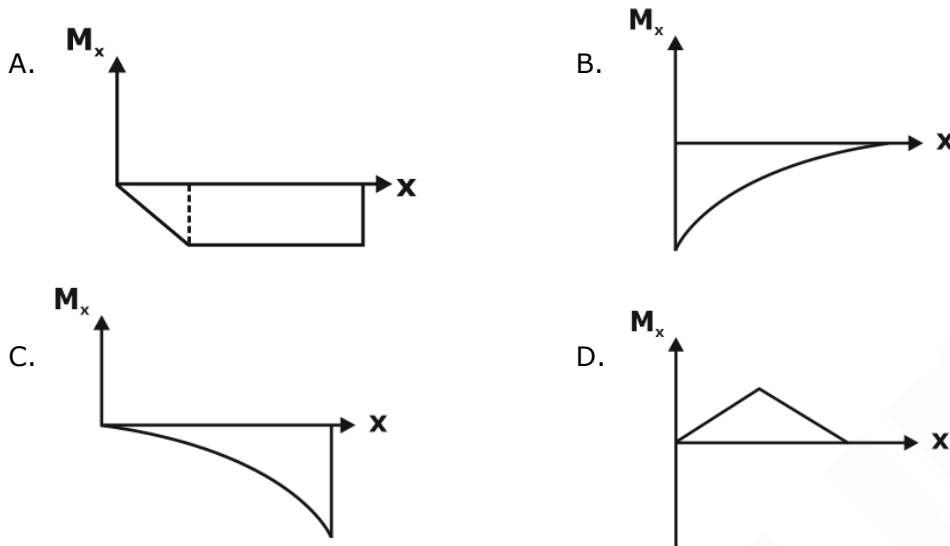
$$D = 20\text{mm,}$$

$$R = 10\text{mm,}$$

$$\text{Coefficient of friction, } \mu = 0.2$$

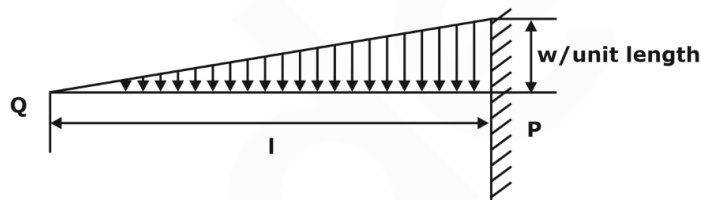
$$\text{Maximum draft} = \mu^2 R = 0.2^2 \times 10 = 0.4 \text{ mm}$$

150. Which of the following is the CORRECT bending moment diagram for the cantilever beam carrying uniformly varying load from zero at free and w /unit length at the fixed end?



Ans. C

Sol.



Consider cantilever beam 'PQ' of length 'l' consisting a uniformly varying load (UvL), w /unit length which is zero at Q and w /unit length at 'P'.

Now, let us consider a section x-x at a distance 'x' from the free end 'Q', Then

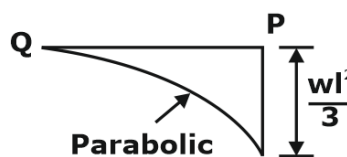
$$\text{Bending Moment } (BM_x) = -\left(\frac{0+w}{2}\right)(x) \times \left(\frac{2}{3}xw\right)$$

$$= -\frac{w}{2} \times \frac{2}{3} \times x^2$$

$$BM_x = \frac{2}{3} \times x^2$$

At point 'Q', $(BM_Q) = 0$

$$\text{At point 'P' } (BM_P) = \frac{-W}{3} l^2$$



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151. For same maximum pressure and heat input, correct relation for air standard efficiencies is _____.

- A. $\eta_{otto} > \eta_{diesel} > \eta_{dual}$
- B. $\eta_{otto} < \eta_{diesel} < \eta_{dual}$
- C. $\eta_{otto} < \eta_{dual} < \eta_{diesel}$
- D. $\eta_{otto} > \eta_{dual} > \eta_{diesel}$

Ans. C

Sol. For the same maximum temperature, the order of efficiency is as follows:

$$\eta_{otto} < \eta_{dual} < \eta_{diesel}$$

152. According to Gibbs phase rule, the number of degrees of freedom of a eutectic point in a binary system is

- A. 0
- B. 1
- C. 2
- D. 3

Ans. A

Sol. An invariant point (where reactions intersect), such as eutectic point, has zero degree of freedom. The reaction occurs at a particular composition and temperature.

153. The iron-carbon diagram and the TTT curves are determined under

- A. equilibrium and non-equilibrium conditions, respectively
- B. non-equilibrium and equilibrium conditions, respectively
- C. equilibrium conditions for both
- D. non-equilibrium conditions for both

Ans. A

Sol. Phase diagrams such as iron-carbon, are under equilibrium, whereas the diagrams of phase transformation, such as TTT curves, are determined under non-equilibrium conditions.

154. Which of the following is not an intensive property?

- A. Pressure
- B. Volume
- C. Temperature
- D. Density

Ans. B

Sol. An intensive property is a bulk property, meaning that it is a local physical property of a system that does not depend on the system size or the amount of material in the system. Examples of intensive properties include temperature, T ; refractive index, n ; density, ρ ; and hardness of an object, η .

155. What will be the second law efficiency of heat engine whose actual efficiency is 25% and operating between 27°C and 927°C ?

- A. 100%
- B. 33.33%
- C. 41.67%
- D. 25%

Ans. B

Sol. Second law efficiency = $\frac{\eta_{\text{actual}}}{\eta_{\text{rev}}}$

$$\eta_{\text{rev}} = 1 - \frac{T_2}{T_1} = 1 - \frac{300}{1200}$$

$$\eta_{\text{rev}} = 1 - 0.25 = 0.75$$

$$\eta_{\text{second law}} = \frac{0.25}{0.75} \times 100 = 33.33\%$$

156. Which of the ideal cycle have two-isothermal and two-isobaric processes?

- A. Atkinson cycle
- B. Stirling cycle
- C. Ericsson cycle
- D. Brayton cycle

Ans. C

Sol. Ericsson cycle consists of four totally reversible processes:

- (a). An isothermal heat addition process from an external source.
- (b). There is a constant pressure, heat regeneration.
- (c). an isothermal heat rejection through a compression process
- (d). Finally a constant pressure regeneration process again.

157. A close-coiled helical spring of stiffness 50 N/mm is arranged in series with another such spring of stiffness 100 N/mm. The stiffness of composite unit is

- A. 150 N/mm
- B. 200 N/mm
- C. 33.33 N/mm
- D. 75 N/mm

Ans. C

Sol. Stiffness of composite unit when spring is in series connection can be calculated as follows:

$$\frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2}$$

$$\frac{1}{k} = \frac{1}{50} + \frac{1}{100}$$

$$\frac{1}{k} = \frac{2+1}{100} = \frac{3}{100}$$

$$k = \frac{100}{3} = 33.33 \text{ N / mm}$$

158. Roaring forties is the name of which planetary winds?

- A. Trade Winds
- B. Westerlies
- C. Polar Easterlies
- D. Western Disturbances

Ans. B

Sol. • **Westerlies Winds are often called Roaring Forties, Furious Fifties and Shrieking Sixties.**

- These winds blow from sub-tropical high-pressure belts towards the sub polar low-pressure belts.
- The westerlies are best developed between **40° and 65°S latitudes.**
- Sailors use the Roaring Forties to speed their passage across the Indian Ocean.

159. A vessel of 10 mm diameter and 20 mm height with corner radius 0.1 mm is to be produced by cup drawing. The required blank diameter in mm is

- A. 30
- B. 20
- C. 10
- D. 25

Ans. A

Sol. Given,

$$d = 10\text{mm}, h = 20\text{mm}$$

by the conservation of mass

$$D^2 = d^2 + 4dh$$

$$D^2 = 10^2 + 4 \times 10 \times 20 = 900$$

$$\text{Therefore, } D = 30 \text{ mm}$$

160. There are two radiating surfaces having area, $A_1 = 5 \text{ m}^2$ and $A_2 = 10 \text{ m}^2$. The ratio of shape factor F_{2-1} to F_{1-2} is:

- A. 2 : 1
- B. 1 : 4
- C. 1 : 2
- D. 1 : 1

Ans. C

Sol. From the reciprocity theorem we know that,

$$A_1 F_{1-2} = A_2 F_{2-1}$$

$$\Rightarrow \frac{F_{2-1}}{F_{1-2}} = \frac{A_1}{A_2} = \frac{5}{10} = \frac{1}{2}$$

So, the correct option is (c).

161. If nusselt number is 3600 with corresponding Reynolds & prandtl number as 60 & 30 respectively, the relevant Stanton number will be

- A. 60
- B. 30
- C. 20
- D. 2

Ans. D

$$\text{Sol. } S_t = \frac{Nu}{Re.Pr} = \frac{3600}{60 \times 30} = 2$$

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162. Coefficient of contraction is the ratio of

- A. Actual velocity of jet at vena contracta to the theoretical velocity
- B. Loss of head at the orifice to the head available at the exit of the orifice
- C. Actual discharge through an orifice to theoretical discharge
- D. Area of the jet at vena contracta to the area of orifice

Ans. D

Sol. Coefficient of contraction: Area of the jet at vena contracta to the area of orifice

Coefficient of velocity: Actual velocity of jet at vena contracta to the theoretical velocity

Coefficient of discharge: Actual discharge through an orifice to theoretical discharge

Coefficient of resistance: Loss of head at the orifice to the head available at the exit of the orifice.

163. What are the co-ordinates of center of Mohr's circle for an element subjected to two mutually perpendicular stresses one tensile of magnitude 80MPa and other compressive of magnitude 50MPa?

- A. (65,0)
- B. (50,0)
- C. (15,0)
- D. (130,0)

Ans. C

Sol. $\sigma_x = 80 \text{ MPa}$,

$\sigma_y = -50 \text{ MPa}$

Co-ordinates of center of Mohr's circle = $[\frac{1}{2}(\sigma_x + \sigma_y), 0]$

= $[(30/2), 0]$

= (15,0)

164. Determine the loss in available energy if the 1000W heat flows through the wall whose one side temperature is 400K and other side is at 300K.? Surrounding temperature is 300K.

- A. 250W
- B. 300W
- C. 400W
- D. 500W

Ans. A

Sol. loss in available energy = $\frac{T_0 Q (T_1 - T_2)}{T_1 T_2}$

$$= \frac{300 \times 1000 (400 - 300)}{400 \times 300}$$

= 250W

165. A cantilever beam having a square cross section of side "S" is subjected to a point load at end. If "S" is decreased by 50%, then the percentage change in the deflection at the free end

- A. 1200%
- B. 500%
- C. 1500%
- D. 800%

Ans. C

Sol. given,

$$a_1 = a, a_2 = a/2$$

for cantilever beam under point load

$$\delta = \frac{WL^3}{3EI} = 3E \frac{WL^3}{a^4}$$

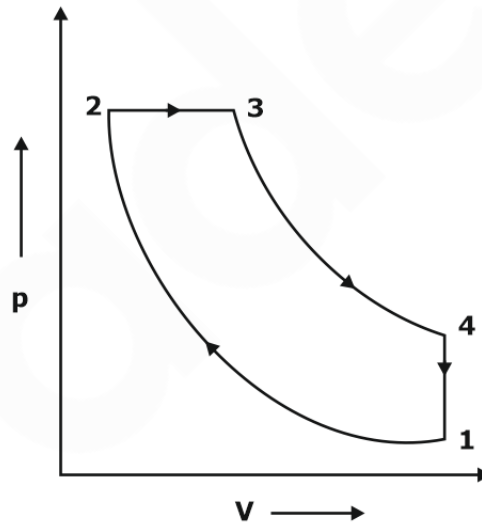
$$\delta \propto \frac{1}{a^4}$$

As the deflection is inversely proportional to the power four of the side, therefore,

$$\frac{\delta_2}{\delta_1} = \frac{\delta_1^4}{a_2^4} \Rightarrow \left(\frac{\delta_2}{\delta_1} - 1\right)\% = \left(\frac{a_1^4}{a_2^4} - 1\right) \times 100$$

$$\left(\frac{\delta_2}{\delta_1} - 1\right)\% = \left(\left(\frac{a}{a/2}\right)^4 - 1\right) \times 100 = 1500\%$$

166. Shown below is the P-V diagram of a diesel cycle. Which of the following represents the cut-off ratio?



A. $\frac{V_3}{V_1}$

B. $\frac{V_2}{V_1}$

C. $\frac{V_3}{V_2}$

D. $\frac{V_2}{V_3}$

Ans. C

Sol. The cutoff ratio of the diesel cycle is given by :

$$\rho = \frac{V_3}{V_2}$$

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167. A pinned-pinned circular column whose slenderness ratio is 'S' is heated uniformly by an external source. If the modulus of elasticity of the column material is E and its coefficient of thermal expansion is α , then calculate the change in temperature required to make the column buckle.

- A. $\frac{\pi^2}{\alpha S^2}$
- B. $\frac{\pi^2 \alpha E}{S^2}$
- C. $\frac{\alpha \pi^1}{S^2}$
- D. $\frac{\alpha E}{S}$

Ans. A

Sol. Column will buckle when thermal stress = Buckling stress

Buckling stress =

$$\sigma = \frac{n^2 EK^2}{l_e^2} \quad S = \frac{l_e}{K}$$

$$\sigma = \frac{n^2 E}{S^2}$$

Thermal stress = $E\alpha\Delta T$

Equating the two,

$$\frac{n^2 E}{S^2} = E\alpha\Delta T$$

$$\Delta T = \frac{\pi^2}{\alpha S^2}$$

168. A compound pipe of diameter d_1 , d_2 , and d_3 having lengths l_1 , l_2 , and l_3 is to be replaced by an equivalent pipe of diameter d and length l , the size of the equivalent pipe is given by

- A. $\frac{1}{d^2} = \frac{l_1}{d_1^2} + \frac{l_2}{d_2^2} + \frac{l_3}{d_3^2}$
- B. $\frac{1}{d^3} = \frac{l_1}{d_1^3} + \frac{l_2}{d_2^3} + \frac{l_3}{d_3^3}$
- C. $\frac{1}{d^4} = \frac{l_1}{d_1^4} + \frac{l_2}{d_2^4} + \frac{l_3}{d_3^4}$
- D. $\frac{1}{d^5} = \frac{l_1}{d_1^5} + \frac{l_2}{d_2^5} + \frac{l_3}{d_3^5}$

Ans. D

Sol. For compound pipe in series,

Total head loss, $h_L = h_{L1} + h_{L2} + h_{L3}$

$$\frac{f \cdot l \cdot Q^2}{12d^5} = \frac{f \cdot l_1 \cdot Q^2}{12d_1^5} + \frac{f \cdot l_3 \cdot Q^2}{12d_3^5}$$

$$\frac{l}{d^5} = \frac{l_1}{d_1^5} + \frac{l_2}{d_2^5} + \frac{l_3}{d_3^5}$$

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169. In brazing process the melting takes place in
- A. parent metal only
 - B. filler metals only
 - C. parent as well as filler metals
 - D. none of the above

Ans. B

Sol. Brazing creates a metallurgical bond between the filler metal and the surfaces being joined. Heat is applied to the base metals and the filler metal is brought into contact with the heated parts. When the filler metal melts, it is drawn through the joint by capillary action.

170. The temperature after compression is given by _____.

- A. $T_2 T_1 \left(\frac{P_2}{P_1} \right)^{\frac{n}{n-1}}$
- B. $T_2 = T_1 \left(\frac{P_2}{P_1} \right)^{\frac{n+1}{n}}$
- C. $T_2 = T_1 \left(\frac{P_2}{P_1} \right)^{\frac{n-1}{n}}$
- D. $T_2 = T_1 \left(\frac{P_1}{P_2} \right)^{\frac{n-1}{n}}$

Ans. C

Sol. Here T_2 is the delivery temperature and is given by the following expression:

$$T_2 = T_1 \left(\frac{P_2}{P_1} \right)^{\frac{n-1}{n}}$$

171. Consider an ideal VCRS (Vapor compression refrigeration cycle), for which the enthalpy of refrigerant before and after the evaporator are 75kJ/kg and 180kJ/kg respectively. Determine the refrigerant flow for each ton of refrigeration required:

- A. 1kg/min
- B. 2 kg/min
- C. 3 kg/min
- D. 4 kg/min

Ans. B

Sol. By definition,

$$Q = \dot{m}(h_1 - h_4)$$

$$\Phi \text{ 1TR} = 210 \text{ kJ/min}$$

$$\therefore 210 = \dot{m}(180 - 75)$$

$$\therefore \dot{m} = \frac{210}{105} = 2 \text{ kg / min}$$

172. The main advantage of sunk key is that it is a _____ drive.

- A. Positive
- B. Negative
- C. Neutral
- D. None of the listed

Ans. A

Sol. Sunk key is a positive drive and no slip occurs.

173. In a free expansion process for ideal gas
- A. Work done is zero
 - B. heat transfer is zero
 - C. Both (a) and (b) above
 - D. None of these

Ans. C

Sol. Free expansion for ideal gas, Work done = zero because, free expansion is a irreversible adiabatic and isothermal process.

Due to isothermal, there is no temperature change and hence no internal energy change occurs.

Due to adiabatic, there is no heat flow between system and surrounding .i.e. $dQ = 0$

174. Reynolds number is the ratio of
- A. square root of Inertia force and viscous force.
 - B. viscous force and inertia force
 - C. Inertia force and viscous force.
 - D. Inertia force and gravity force.

Ans. C

Sol. Reynolds number is dimensionless number and it is the ratio of inertia force and viscous flow. We can differentiate between laminar and turbulent flow with the help of Reynolds Number.

175. The permissible bending moment in a circular shaft under pure bending is M according to maximum principal stress theory of failure. According to maximum shear stress theory of failure, the permissible bending moment in the same shaft is

- A. $1/2M$
- B. M
- C. \sqrt{M}
- D. $2M$

Ans. B

Sol. $\sigma = \frac{16}{\pi d^3} (M + \sqrt{M^2 + T^2})$ and $\tau = \frac{16}{\pi d^3} (\sqrt{M^2 + T^2})$ put $T = 0$

$$\sigma_{yt} = \frac{32M}{\pi d^3} \text{ and } \tau = \frac{16M'}{\pi d^3} = \frac{\sigma_{yt}}{2} = \frac{\left(\frac{32M}{\pi d^3}\right)}{2} = \frac{16M}{\pi d^3} \text{ Therefore } M' = M$$

176. Axial flow compressor has following advantages over the centrifugal compressor
- A. Higher pressure ratio per stage
 - B. Aerofoils blades are used
 - C. Large air handling ability per unit frontal area
 - D. Higher average velocity

Ans. C

Sol. Advantages of the axial compressor are its higher flow rate and greater pressure ratio, which results in higher thrust and fuel efficiency. This makes it better suited to applications where the thrust of the engine itself is the motive force for the aircraft.

177. When a liquid rotates at constant angular velocity about a vertical axis as a rigid body, the pressure
- A. increases linearly as its radial distance
 - B. vanes inversely as the altitude along any vertical line
 - C. varies as the square of the radial distance
 - D. decreases as the square of the radial distance

Ans. C

Sol. When a liquid rotates at constant angular velocity about a vertical axis as a rigid body, the pressure varies as the square of the radial distance

178. Out of the following refrigerant shown below, which of the following has the lowest boiling point?
- A. Ammonia
 - B. Carbon Dioxide
 - C. Sulphur dioxide
 - D. R-12

Ans. B

Sol. Carbon Dioxide has the lowest boiling point among all the above refrigerants.

boiling point of ammonia = $-33.34\text{ }^{\circ}\text{C}$

boiling point of carbon dioxide = $-78.46\text{ }^{\circ}\text{C}$

boiling point of sulphur dioxide = $-10\text{ }^{\circ}\text{C}$

boiling point of R-12 = $-29.8\text{ }^{\circ}\text{C}$

179. Metacentric radius of a floating body is the ratio of
- A. Moment of inertia of vertical section to volume of liquid displaced
 - B. Moment of inertia of section at liquid plane to volume of liquid displaced
 - C. Moment of inertia of section at liquid plane to volume of body
 - D. Moment of inertia of vertical section to volume of body

Ans. B

Sol. Metacentric radius is given by $\frac{I}{V}$,

where I is the moment of inertia of section at liquid plane of body and V is the volume of the liquid displaced.

180. Power transmitted through a pipe is maximum when where H = total head supplied $H_L =$ Head loss due to friction
- A. $H_L = \frac{H}{2}$
 - B. $H_L = \frac{H}{3}$
 - C. $H_L = \frac{H}{4}$
 - D. $H_L = H$

Ans. B

Sol. For maximum power transmission

$$H_L = \frac{H}{3}$$

181. Desirable property of a refrigerant is

- A. High boiling point
- B. Low critical temperature
- C. Low latent heat of vaporization
- D. Low viscosity

Ans. D

Sol. Desirable properties of a refrigerant is:

- Low boiling point
- high critical temperature
- high latent heat of vaporization
- Non-toxic
- Non-flammable
- Low viscosity
- Low freezing point

182. Degree of reaction in a turbine is the ratio of _____.

- A. Enthalpy drop in fixed blade to total enthalpy drop
- B. Enthalpy drop in moving blade to total enthalpy drop
- C. Enthalpy drop in fixed blade to enthalpy drop in moving blade
- D. Enthalpy drop in moving blade to enthalpy drop in fixed blade

Ans. B

Sol. Degree of reaction in a turbine is the ratio of enthalpy drop in moving blade to total enthalpy drop.

o Degree of reaction (R) = $\frac{\text{Enthalpy drop in rotor}}{\text{Enthalpy drop in stage}}$

183. Availability function for a closed system is given by _____.

- A. $u - pv - Ts$
- B. $u + pv + Ts$
- C. $u - pv + Ts$
- D. $u + pv - Ts$

Ans. D

Sol. Availability = $W_{\text{useful}} - W_{\text{max}} = P_0(V_0 - V_1)$

Consider a system which interacts with the ambient at T_0 .

Then,

$$W_{\text{max}} = (U_1 - U_2) - T_0(S_1 - S_0)$$

184. The polytropic equation $PV^n = C$, what is the value of 'n' for isentropic, constant pressure, constant volume, isothermal process respectively is given as

- A. $n=k, n=0, n=\infty, n=1$
- B. $n=0, n=k, n=\infty, n=1$
- C. $n=\infty, n=0, n=k, n=1$
- D. $n=k, n=1, n=\infty, n=1$

Ans. A

Sol.

| Process | Value of 'n' |
|-------------------|--------------|
| Constant pressure | 0 |
| Isothermal | 1 |
| Isentropic | K |
| Constant volume | ∞ |

185. In Blanking, clearance is provided on

- A. Punch
- B. Die
- C. Punch and Die both
- D. none of these

Ans. A

Sol. In Blanking, clearance is provided on Punch, while in Punching, clearance is provided on Die.

186. Determine the coefficient of performance (COP) of a Carnot cycle refrigerator operating between 250°K and 300°K.

- A. 0.8
- B. 1.2
- C. 5.0
- D. 6.0

Ans. C

Sol. By definition of COP:

$$(COP)_R = \frac{T_2}{T_1 - T_2} = \frac{250}{300 - 250} = 5$$

187. Which of the following equation is known as the inequality of Clausius _____.

- A. $\oint \frac{dQ}{T} \leq 0$
- B. $\oint \frac{dQ}{T} \geq 0$
- C. $\oint \frac{dQ}{T} = 0$
- D. $\oint \frac{dQ}{T} > 0$

Ans. A

Sol. $\oint \frac{dQ}{T} \leq 0$ is known as the inequality of Clausius.

So, the correct option is (a).

188. A gas turbine cycle having turbine output 200 kW and overall efficiency 60%. Mass of fuel consumed is 20 kg/hr and calorific value of fuel is 45000 kJ/kg. Find work input to the compressor.

- A. 50 kW
- B. 65 kW
- C. 80 kW
- D. 100 kW

Ans. A

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Sol. Heat supplied = $m_f \times C = 20 \times 45000 / 3600 = 250$ kW

Efficiency = (Net work output)/(Heat supplied)

$$0.60 = \frac{W_{\text{net}}}{250}$$

$$W_{\text{net}} = 250 \times 0.60 = 150 \text{ kW}$$

Turbine work (W_T) - compressor work (W_C) = 150 kW

$$200 - W_C = 150$$

$$W_C = 50 \text{ kW}$$

189. There is a thermal insulation of thermal conductivity 0.67 W/mK applied to a hollow spherical container. The convective heat transfer coefficient at the outer surface of insulation is 20 W/m²K. The critical radius of insulation will be:

- A. 0.67 m
- B. 0.067m
- C. 0.0335 m
- D. 6.7 m

Ans. B

Sol. Thermal conductivity, $K = 0.67$ W/mK

Heat transfer coefficient, $h = 20$ W/m²K

$$\text{Critical radius of insulation of sphere} = \frac{2K}{h} = \frac{2 \times 0.67}{20} = 0.067\text{m}$$

So, the correct option is (b)

190. In a single-spindle automatic lathe, the turret indexing is done using

- A. Ratchet and Pawl mechanism
- B. Geneva mechanism
- C. Rack and Pinion mechanism
- D. Whitworth mechanism

Ans. A

Sol. Indexing of turret is done using Ratchet and Pawl mechanism.

191. Which one of the following materials has poisson's ratio more than 1?

- A. Cork
- B. Wood
- C. Plastic
- D. None

Ans. D

Sol. Poisson's ratio can not be greater than 0.5.

192. Action and reaction

- A. have equal magnitude
- B. have resultant zero
- C. act in opposite direction
- D. all of these

Ans. D

Sol. According to the Newton's third law of motion, Action and reaction are equal and acts in opposite directions

193. A Pelton wheel with single jet rotates at 600 rpm. The velocity of the jet from the nozzle is 100m/s. If the ratio of the vane velocity of jet velocity is 0.44, what is the diameter of the Pelton wheel?

- A. 0.7 m
- B. 1.4 m
- C. 2.1 m
- D. 2.8 m

Ans. B

Sol. as per question

Rotational speed(N)=600 rpm

Velocity of jet from nozzle (V₁) 100 m/s

Vane velocity/jet velocity $\left[\frac{u}{V_1} \right] = 0.44$

Let, d = diameter of pelton wheel

$u = \frac{\pi d N}{60} \Rightarrow 44 = \frac{\pi \times d \times 600}{60}$

$d = \frac{44 \times 60}{3.14 \times 600} = 1.4m$

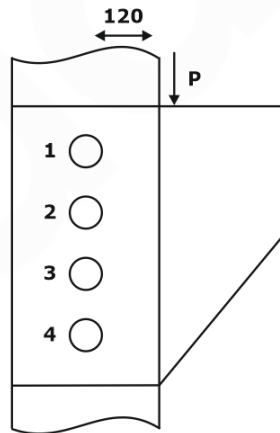
194. Which of the Following instrument used for measurement of very small displacement.

- A. LVDT
- B. Optical flat
- C. Diffraction grating
- D. Laser scan microscope

Ans. C

Sol. Diffraction grating is used for measurement of very small displacement.

195. A bracket is attached to a vertical wall by means of four rivets as shown in figure below. Find the rivet which is under maximum stress.



- A. 1 and 4
- B. 2 and 3
- C. 3 and 1
- D. 4 and 2

Ans. A

Sol. Primary Shear act vertically upward on all the rivets. Secondary shear is proportional to the distance from CG. Hence rivets 1 and 4 are under maximum stress.

196. In case of regeneration of Rankine cycle which of the following is incorrect _____.

- A. Thermal efficiency decreases
- B. Heat supplied decreases
- C. Net work done increases.
- D. Pump work remains constant

Ans. A

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Sol. **For the regeneration process:**

- Net work done decreases.
- The heat supplied decreases because some steam escaped from the turbine to heat the feed water.
- Thermal efficiency increases.

197. Which of the following are the assumptions are made in the derivation of Euler’s equation of motion?

- A. Flow is laminar
- B. Flow is irrotational
- C. Flow is inviscid
- D. All of the above

Ans. D

Sol. Following are the assumptions of Euler’s equation of motion

- * Flow is laminar
- * Flow is irrotational or flow is along a stream line
- * Flow is inviscid

198. In a grinding wheel designation given by A 50 G 8 B 23, 'B' stands for

- A. Rubber bond
- B. Shellac bond
- C. Resinoid bond
- D. Silicate bond

Ans. C

Sol. B stands for resinoid in the designation of grinding wheel.

199. Match List I with List II and select the correct answer using the codes given below the lists.

| List-1 | List-2 |
|-------------------------------|---------------------------|
| (Measuring Instrument) | (Variable to be measured) |
| A. Pitot-tube pressure | 1. Flow static |
| B. Micro-manometer (indirect) | 2. Rate of flow |
| C. Pipe bend meter pressure | 3. Differential |
| D. Wall pressure tap pressure | 4. Flow stagnation |

- A. A-1; B-3; C-2; D-4
- B. A-4; B-3; C-2; D-1
- C. A-1; B-2; C-3; D-4
- D. A-4; B-2; C-3; D-1

Ans. B

Sol. Option B is correct.

200. A Rhombohedral unit cell satisfies which of the following equations?

- A. $a=b=c, \alpha=\beta=\gamma=90$ degree
- B. $a\neq b=c, \alpha=\beta=\gamma=90$ degree
- C. $a=b\neq c, \alpha=\beta=\gamma=90$ degree
- D. $a=b=c, \alpha=\beta=\gamma\neq 90$ degree

Ans. D

Sol. Rhombohedra have all sides equal and all angles equal but not 90 degrees.

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