MEGA MOCK CHALLENGE

gradeup

SSC JE 2019-20

Mechanical Engineering

Mega Mock Challenge
(May 09- May 10 2020)

Questions & Solutions

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

Trim : Hair

A. Dog : Stag
B. Eye : Red
C. Prune : Shrub
D. Nail : Face

Ans. C

Sol. We trim hair to shorten the length of hair in a same way prune does shorten the length of shrub.

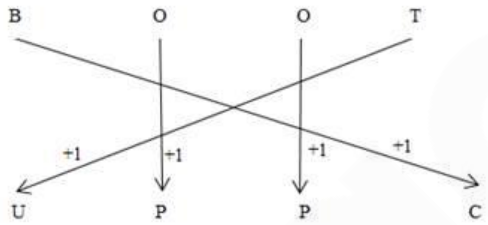
Hence, option C is the correct answer.

2. In a certain code language, 'BOOT' is written as 'UPPC'. How is 'LOOP' written in that code language?

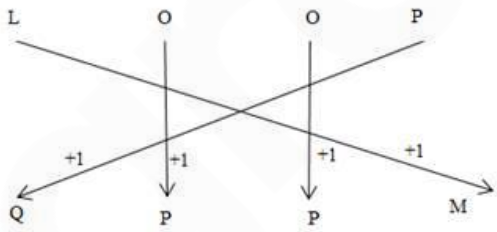
A. NPPT
B. QPPM
C. KPPT
D. LPPG

Ans. B

Sol. BOOT is written as UPPC



Similarly, LOOP is written as,



So, LOOP is written as QPPM.

Hence, option B is the correct answer.

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

119 : 10 :: 476 : ?

A. 65
B. 55
C. 24
D. 52

Ans. D

Sol. 1× (1 + 9) = 1 × 10 = 10

In the same way,

4 × (7 + 6) = 4 × 13 = 52

Thus, 119 : 10 :: 476 : 52

Hence, option D is the correct answer.

4. Which of the following will appear third, if they are arranged according to a dictionary

(A) Autumn (B) Austere

(C) Assert (D) Auspicious

A. (A) B. (B)

C. (C) D. (D)

Ans. B

Sol. After arranging the given words,

(C) Assert (D) Auspicious

(B) Austere (A) Autumn

Hence, Austere will appear third, if they are arranged according to a dictionary.

Hence, option B is the correct answer.

5. A + B means 'A is the daughter of B'

A - B means 'A is the wife of B'

A x B means. 'A is the husband of B'

A ÷ B means 'A is the father of B'

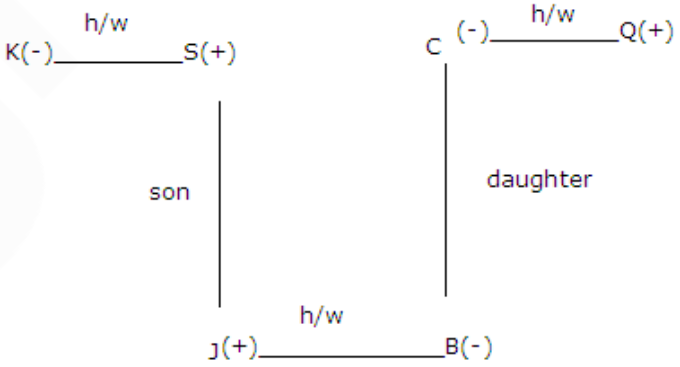
How is Q related to J in the expression K - S ÷ J x B + C - Q?

A. Father B. Father-in-law

C. Maternal grandfather D. Son

Ans. B

Sol. The expression K - S ÷ J x B + C - Q can be represented as given below-



From the above diagram its clear that Q is the father-in-law of J.

Hence, option B is the correct answer.

6. Study the statements, select the right conclusion.
Statement : In recent survey report, it is said that who eat green vegetables daily they face less heart problems.
Conclusion :
I. Eating green vegetables is necessary for healthy life.
II. All people who are doing sitting job, necessarily faces heart problems
A. Only conclusion I follows
B. Neither I nor II conclusion follows
C. Only conclusion II follows
D. Either I or II conclusion follows

Ans. A

Sol. According to a recent survey, eating green vegetables are necessary for healthy life as they help in reducing the health problem.
Hence, conclusion I follows.
Hence, option A is the correct answer.

7. If 'A' denotes '+', 'B' denotes '-', 'C' denotes '÷' and 'D' denotes '×', then what will be the value of the following expression?
87 B 56 C 8 A 4 D 5
A. 110
B. 120
C. 100
D. 140

Ans. C

Sol. Its given that 'A' denotes '+', 'B' denotes '-', 'C' denotes '÷' and 'D' denotes '×'.
87 B 56 C 8 A 4 D 5
After interchanging-
87 — 56 ÷ 8 + 4 ×5
Apply BODMAS,
87 — 56 ÷ 8 + 4 ×5
=87 — 7 + 20
=80+20=100
Hence, option C is the correct answer.

8. A series is given with one term missing. Select the correct alternative from the given ones that will complete the series.
Q, P, M, H,?
A. E
B. A
C. Z
D. X

Ans. B

Sol. Given series follows the pattern given below:

$$Q \xrightarrow{-1} P \xrightarrow{-3} M \xrightarrow{-5} H \xrightarrow{-7} A$$

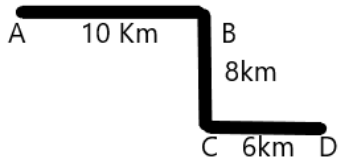
Hence, option B is the correct answer.

9. A man walks 10 km towards east, then takes a right turn and walks 8 km and again takes left and walks 6 km. In which direction is the man with respect to his starting position?

A. Northeast
B. Southwest
C. Southeast
D. Northwest

Ans. C

Sol.



As the man starts from point A and reaches at point D according to the question. So, the direction of the man at D with respect to A is South East.

Hence, option C is the correct answer.

10. Select the option which is related to the third number as the second number is related to the first number.

16 : 68 :: 28 : _____

A. 119
B. 77
C. 346
D. 49

Ans. A

Sol. As, 16*(17/4)=68

Similarly, 28*(17/4)=119

Hence, option A is the correct answer.

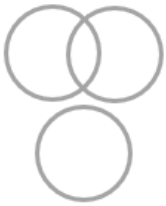
11. Identify the diagram that best represents the relationship among the given classes.

Lake, Men and Employee

A. 

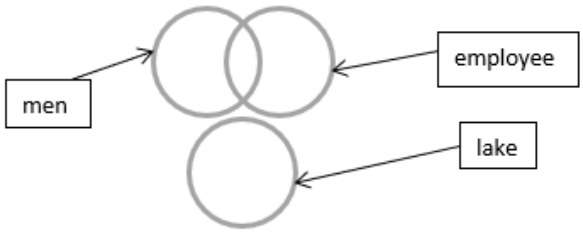
B. 

C. 

D. 

Ans. D

Sol. Some men can be an employee. But Lake is completely a different entity.



Hence, option D best represents the relationship between the given classes.

Hence, option D is the correct answer.

12. Select the option in which the words share the same relationship as that shared by the given set of words (in the same order).

Slit : Pierce : Cut

A. Work : Rest : Play
B. Less : Few : More
C. Harrow : Plough : Dig
D. Watch : Ignore : Disregard

Ans. C

Sol. As, Slit, Pierce and Cut have the same meanings.

Similarly,

Harrow, Plough and Dig have the same meanings.

Hence, option C is the correct answer.

13. 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:

1. Some Boys are Girls.
2. No Boys are students.

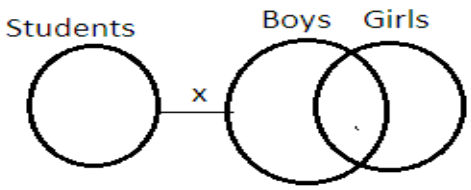
Conclusions:

I. All girls can be students.
II. No students are boys.

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

Ans. A

Sol. The least Possible Venn-diagram is-



Conclusion:

I. All girls can be students -(It does not follow as No Boys are students given in the statement.)

II. No students are boys -(It follows as clearly given that No Boys are students.)

So, only conclusion II follows.

Hence, option A is the correct answer.

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

A. Square B. Rectangle

C. Cylinder D. Triangle

Ans. C

Sol. All are 2-Dimensional figures except 'Cylinder'.

Hence, option C is the correct answer.

15. In the following number series, which number will replace the question mark (?) in the series?

3, ?, 101, 10202

A. 95 B. 10

C. 99 D. 100

Ans. B

Sol. Logic-

$3^2+1=9+1=10$

$10^2+1=100+1=101$

$101^2+1=10201+1=10202$

Hence, option B is the correct answer.

16. In a row of boys, Shiv is 7^{th} from the left and Saurabh is 9^{th} from the right. When they exchange their positions, Shiv becomes 15^{th} from left. What will be the Saurabh's new position from right?

A. 16 B. 17

C. 15 D. 18

Ans. B

Sol. Shiv = 7^{th} from left

Saurabh = 9^{th} from right.

After exchanging Position, Shiv = 15^{th} from left so, after Shiv there are 8 boys.

Total number of boys = 15 + 8 = 23

Saurabh = 7^{th} from left, => 23 – 7 + 1 = 17^{th} from right.

Hence, option B is the correct answer.

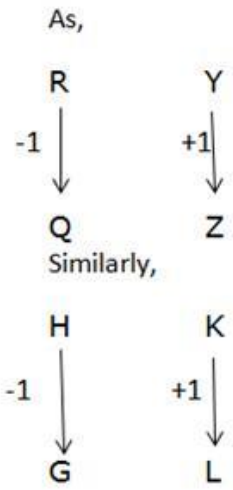
17. Select the option that is related to the third term in the same way as the second term is related to the first term.

RY : QZ : : HK : _____

A. GL
B. IM
C. GJ
D. IL

Ans. A

Sol.



Hence, option A is the correct answer

18. Three of the following four option are similar in a certain way and one is different. Find the one that is different.

A. 14 - 70 – 85
B. 9 - 45 – 60
C. 11 - 55 – 70
D. 7 - 42 – 58

Ans. D

Sol. From the given options,

Option A – (14 - 70 – 85)

14 x 5 = 70

70 +15 = 85

Option B - (9 - 45 – 60)

9 x 5 = 45

45 +15 = 60

Option C - (11 - 55 – 70)

11 x 5 = 55

55 +15 = 70

Option D - (7 - 42 – 58)

7 x 6 = 42

42 +16 = 58

Hence, option D is the correct answer.

19. Arrange the given words in the sequence in which they occur in the dictionary.

1) Attempt
2) Alert
3) Attach
4) Assistant
5) Assume

A. 13452
B. 24531
C. 42531
D. 53412

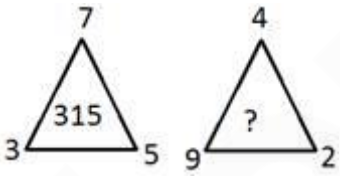
Ans. B

Sol. Arranging the words in the order they appear in the dictionary:

2) Alert
4) Assistant
5) Assume
3) Attach
1) Attempt

Hence, option B is the correct answer.

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



A. 126
B. 216
C. 326
D. 387

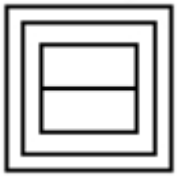
Ans. B

Sol. We have, (7*3*5)*3=105*3=315

Therefore, missing number=(4*9*2)*3=72*3=216

Hence, option B is the correct answer.

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

A. 
B. 
C. 
D. 

Ans. D

Sol. After observing the given diagram carefully, the question figure is embedded in option figure (D).

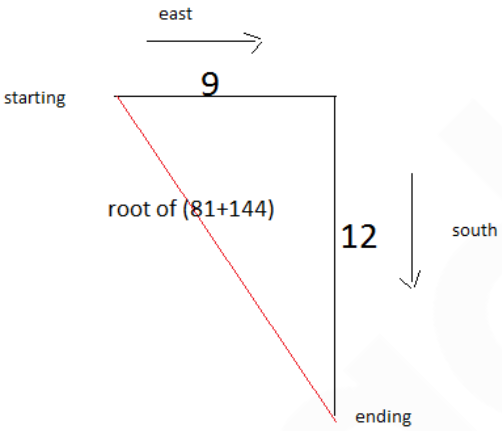
Hence, option D is the correct answer.

22. A man walked 9 km towards East and then 12 km towards South. How far is he from the starting point?

A. 8 km
B. 6 km
C. 15 km
D. 7.5 km

Ans. C

Sol.



Distance between starting and ending point

$= \sqrt{(9^2 + 12^2)}$

$= \sqrt{(81 + 144)}$

$= \sqrt{225}$

$= 15$km

Hence, option C is the correct answer.

23. In the following four words, three words are same in a certain context and one word is different from others. Find the different word.

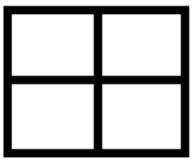
A. Shoot
B. Purify
C. Oar
D. Guard

Ans. C

Sol. Except Oar, all are the action taken by a certain tool. An oar is a tool.

Hence, option C is the correct answer.

24. How many rectangles are there in the given figure?

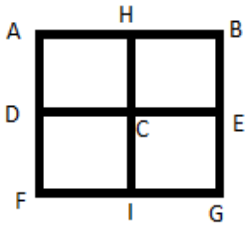


A. 10 B. 9

C. 12 D. 8

Ans. B

Sol. In this question, we show that the figure is given below,



Number of rectangles - ADHC, CHBE, DFCI, CIGE, AHFI, HIGB, ADEB, DFGE, ABFG

So, the total number of triangles is 9.

(Note: every square is a rectangle because it is a quadrilateral with all four angles right angles but not every rectangle is square).

Hence, option B is the correct answer.

25. In the following question, select the odd letter from the given alternatives.

R : X :: V : ?

A. B B. P

C. K D. W

Ans. A

Sol. As,

$R \xrightarrow{+6} X$

Similarly,

$V \xrightarrow{+6} B$

Thus, R : X :: V : B

Hence, option A is the correct answer

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

A. India : Kolkata B. Grocer : Shop

C. Pilot : Cockpit D. Engineer : Site

Ans. A

Sol. Except for India(Country) : Kolkata(old capital), all show relationship- Worker: its working place

Hence, option A is the correct answer.

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

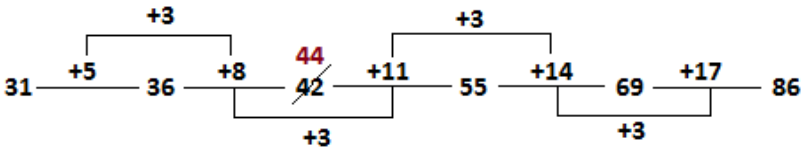
31, 36, 42, 55, 69, 86

A. 42 B. 55

C. 86 D. 31

Ans. A

Sol.



Hence, option A is the correct answer.

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

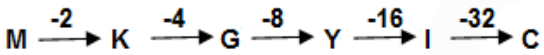
M, K, G, Y, I, ?

A. A B. E

C. C D. G

Ans. C

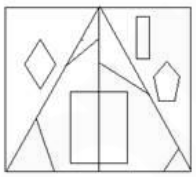
Sol. In this question, we show that –

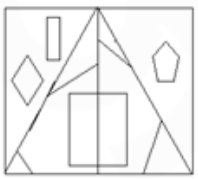


So ? = C

Hence, option C is the correct answer.

29. If a mirror is placed on the right-hand side of the given figure, then which of the answer figures is the right image of the given figure?



A. 

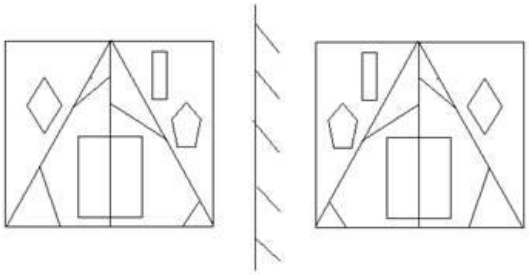
B. 

C. 

D. 

Ans. D

Sol. The correct right image of the given figure is depicted in option figure D.



Hence, option D is the correct answer.

30. Which of the given responses would be a meaningful order of the following?

1) Item
2) Delivery
3) Flipkart
4) Review
5) Buy

A. 3, 1, 5, 2, 4
B. 1, 3, 5, 2, 4
C. 3, 1, 2, 5, 4
D. 3, 1, 5, 4, 2

Ans. A

Sol. 3) Flipkart [first you go to any online shopping website as here mentioned flipkart]

1) Item [Now you search for your item]

5) Buy [then you purchase/buy it]

2) Delivery [then you get your product at your respective address]

4) Review [after checking/using the item you write a review]

Correct sequence = 3, 1, 5, 2, 4

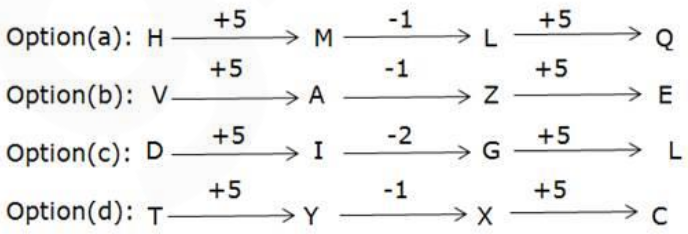
Hence, option A is the correct answer.

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

A. HMLQ
B. VAZE
C. DIGL
D. TYXC

Ans. C

Sol.



Hence, option C is the correct answer.

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

A. 43 : 34 B. 25 : 52

C. 58 : 85 D. 67 : 76

Ans. C

Sol. In option C, the number pair follows the pattern of even: odd while in rest of the options the combination is odd: even.

Hence, option C is the correct answer.

33. Select the number-pair in which the two numbers are related in the same way as are the two numbers of the following number-pair.

42 : 56

A. 17 : 49 B. 22 : 44

C. 35 : 51 D. 12 : 20

Ans. D

Sol. The series is:

6 x 7 = 42 : 7 x 8 = 56

Similarly,

3 x 4 = 12 : 4 x 5 = 20

Hence, option D is the correct answer.

34. If ROSE is written as 63, HELP is written as 47, then GOOD will be written as?

A. 45 B. 43

C. 41 D. 47

Ans. D

Sol. In this question, we show that-

Adding the place value of the letters of the word ROSE –

18 + 15 + 19 + 5 = 57

Now again adding 6 to it = (57 + 6) = 63

For HELP –

8 + 5 + 12 + 16 = 41

Now again adding 6 to it = (41 + 6) = 47

For GOOD –

7 + 15 + 15 + 4 = 41

Now again adding 6 to it = (41 + 6) = 47

Hence, option D is the correct answer.

35. Two conclusions I and II are given after two statements. Considering the statements to be true, even if they may show variance at general accepted rule, and decide which conclusion follow the given statement logically.

Statement:

a) Some watches are devices.

b) Some devices are hands.

Conclusion:

I. Some hands are watches.

II. No hand is watch.

A. Only conclusion II follows

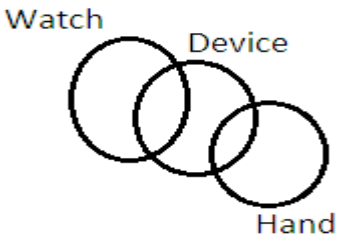
B. Neither conclusion I nor conclusion II follow

C. Only conclusion I follows

D. Either conclusion I or conclusion II follows

Ans. D

Sol. Minimum Possible diagram is-



Conclusion:

I. Some hands are watches.(It does not follow independently as its just a possibility, not surety.)

II. No hand is watch. (It also does not follow independently as its just a possibility, not surety.)

As, we see no negative statements given in the questions, so here some + No will make either or occurrence situation.

So, Either conclusion I or conclusion II follows.

Hence, option D is the correct answer.

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

JY : 35 : : RT : ?

A. 48

B. 38

C. 35

D. 24

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

Here, J + Y = 10 + 25 = 35

Likewise, R + T = 18 + 20 = 38

Hence, option B is the correct answer

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

A. GJIL
B. MPNQ
C. VYXA
D. JMLO

Ans. B

Sol. Pattern is-

Option(a)- G $\xrightarrow{+3}$ J $\xrightarrow{-1}$ I $\xrightarrow{+3}$ L

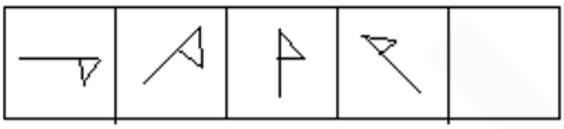
Option(b)- M $\xrightarrow{+3}$ P $\xrightarrow{-2}$ N $\xrightarrow{+3}$ Q

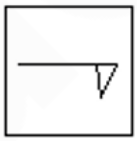
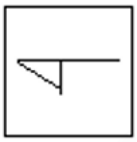
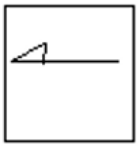
Option(c)- V $\xrightarrow{+3}$ Y $\xrightarrow{-1}$ X $\xrightarrow{+3}$ A

Option(d)- J $\xrightarrow{+3}$ M $\xrightarrow{-1}$ L $\xrightarrow{+3}$ O

Hence, option B is the correct answer.

38. Select the figure that will come next in the following series:



A. 
B. 
C. 
D. 

Ans. D

Sol. Logic - Figure is moving 45° anti clock wise.

So, the nest figure is

Hence, option D is the correct answer.

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

A. 

B. 

C. 

D. 

Ans. A

Sol. As shown below option A is the right image to complete the given figure –

 .

Hence, option A is the correct answer.

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

A. OSUV

B. DFHJ

C. JLNP

D. CEGI

Ans. A

Sol. The pattern is:

D (+2) = F, F (+2) = H, H (+2) = J.

J (+2) = L, L (+2) = N, N (+2) = P.

C (+2) = E, E (+2) = G, G (+2) = I.

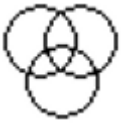
But,

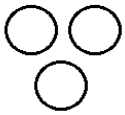
O (+4) = S, S (+2) = U, U (+1) = V.

Hence, option A is the correct answer.

41. Which of the following diagrams indicates the best relation between administration, finance, accounts?

A. 

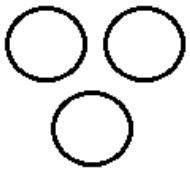
B. 

C. 

D. 

Ans. C

Sol. Administration, finance and accounts are different types of departments in any organization, there is no relationship between them. Hence, all the three are represented by three different circles.



Hence, option C. is the correct answer.

42 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. C

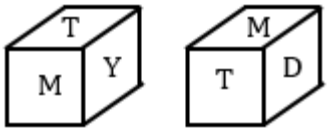
Sol. The paper is unfolded in two steps:-

Step-1

Step-2

Hence, option C is the correct answer.

43. Find the letter is opposite to Y?



A. P B. D

C. T D. M

Ans. B

Sol. According to the rule, when two faces are the same in two different positions of dice then the face which is not common is opposite to each other. Therefore, D is the opposite of Y. Hence, option B is the correct answer.

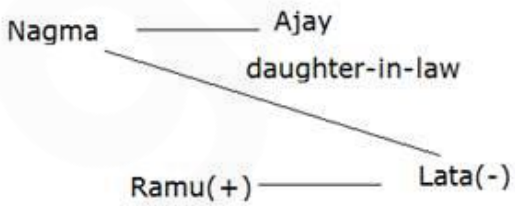
44. Ramu married to Lata who is the daughter-in-law of Nagma. Nagma is married to Married to Ajay, How is Ajay related to Lata?

A. Father-in-law B. Mother

C. Mother-in-law D. Can't be determined

Ans. D

Sol. From the information given in the question, we can draw the following diagram-



Its clear from the above figure that the gender of either Nagma or Ajay is not defined.(Name does not specify the gender)

Therefore, we Can not determine the exact relationship between Ajay and Lata.

Hence, option D is the correct answer.

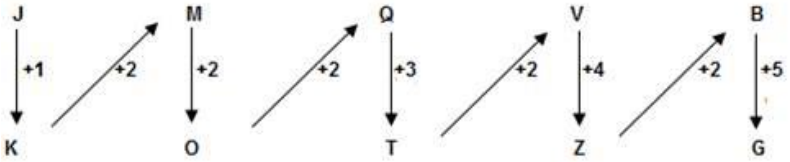
45. A series is given with one term missing. Select the correct alternative from the given ones that will complete the series.

JK, MO, QT, VZ,?

A. BH
B. BF
C. BG
D. CG

Ans. C

Sol. In this question, we show that –



So ? = BG

Hence, option C is the correct answer.

46. Three of the following four option are similar in a certain way and one is different. Find the one that is different.

A. 7 — 21 — 126
B. 4 — 12 — 72
C. 5 — 15 — 105
D. 9 — 27 — 162

Ans. C

Sol. Pattern folows here is:

7*3=21, 21*6=126

4*3=12,12*6=72

5*3=15, 15*7=105

9*3=27,27*6=162

Hence, option C is the correct answer.

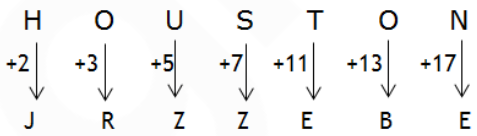
47. If HOUSTON is coded as JRZZEBE, then how will HOWDY be coded as?

A. JROUJ
B. JMQKJ
C. JRBKJ
D. JRBLT

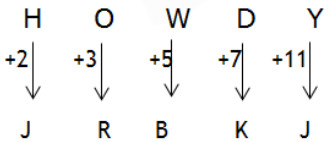
Ans. C

Sol. Logic- Addition of consecutive prime numbers.

As,



Similarly,



Hence, option C is the correct answer.

48. From the given words, select the word which can be formed using the letters of the given word.

DIVERSIFY

A. SERIF
B. DERMIS
C. FIBERS
D. FRISKY

Ans. A

Sol. DERMIS → Letter 'M' is not present in word DIVERSIFY.
FIBERS → Letter 'B' is not present in word DIVERSIFY.
FRISKY → Letter 'K' is not present in word DIVERSIFY.
All letters of the word SERIF are present in DIVERSIFY.
Thus word SERIF can be formed from the word DIVERSIFY.
Hence, option A is the correct answer.

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

9, 23, 43, ?, 101

A. 64
B. 69
C. 67
D. 60

Ans. B

Sol. Logic is-
$(2^3-1^3)+2=(8-1)+2=7+2=9$
$(3^3-2^3)+4=(27-8)+4=19+4=23$
$(4^3-3^3)+6=(64-27)+6=37+6=43$
$(5^3-4^3)+8=(125-64)+8=61+8=69$
$(6^3-5^3)+10=(216-125)+10=91+10=101$
Hence, option B is the correct answer.

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

Potato : Starch : : Stevia : ?

A. Milk
B. Salt
C. Sugar
D. Butter

Ans. C

Sol. Potato starch is the starch extracted from potatoes. Similarly, Stevia is a sweetener and sugar substitute derived from the leaves of the plant species.
Hence, option C is the correct answer.

51. What is the ratio of inertial mass to gravitational mass?

A. 1
B. 2
C. ½
D. 4

Ans. A

Sol. * The ratio of inertial mass to gravitational mass is 1, Because Inertial mass = gravitational mass.

* Inertial mass is a mass parameter giving the inertial resistance to acceleration of the body when responding to all types of force.

* Gravitational mass is determined by the strength of the gravitational force experienced by the body when in the gravitational field g.

52. The National People's Congress of China is located in which city of China?

A. Shanghai
B. Hangzhou
C. Beijing
D. Shenzhen

Ans. C

Sol. • The National People's Congress (NPC) is located in Beijing, China.

• The National People's Congress is the most massive parliamentary body in the world with 2,924 members.

• The National People's Congress (NPC) is the highest organ of state power and the national legislature of the People's Republic of China.

• The Constitution of the People's Republic of China guarantees the Communists Party as the supreme leader and political authority in the country.

53. The pigment that gives colour to human skin, hair and eyes is called _____.

A. Phthalocyanine
B. Melanin
C. Quinacridone
D. Alizarin

Ans. B

Sol. • The pigment that gives human skin, hair and eyes their colour is called Melanin.

• Dark-skinned people have more melanin in their skin than light-skinned people.

• Melanin is produced by cells called melanocytes.

54. Cold currents flow from _____ to _____.

A. Equator to Pole
B. Pole to Equator
C. Random Distribution
D. Along Equator

Ans. B

Sol. • Cold Currents flow from Pole to Equator.

• Cold currents bring cold water into warm water areas.

• They flow in the anti-clockwise direction in the northern hemisphere and in the clockwise direction in the southern hemisphere.

• Examples- Somali Current, West Australian Current, Labrador Current, California Current etc.

55. Who was not among the founders of Poona Sarvajanik Sabha?

A. M G Ranade
B. S H Chiplunkar
C. Ganesh Vasudev Joshi
D. Jaganath Shanker Seth

Ans. D

Sol. Poona Sarvajanik Sabha was founded in 1870 by Mahadev Govind Ranade, Ganesh Vasudeo Joshi, S. H. Chiplunkar.

• It was a socio-political organisation which worked as a mediating body between the government and people of India.

• It published a quarterly journal to put forth the problems of people before the government.

• The ruler of Aundh state, B Shriniwasrao was the first President of the organisation.

56. Which of the following bank launched a prepaid card "Enkasu" in march 2020 ?

A. Axis Bank
B. Karur Vysya Bank
C. State Bank of India
D. Laxmi Vilas Bank

Ans. B

Sol. • Karur Vysya Bank launched a prepaid card "Enkasu" in march 2020.

• The function of this card is based on Near Field Communication Technology.

• The headquarters of Karur Vysya Bank is in Karur, Tamil Nadu and the tagline of this bank is Smart Way to Bank.

57. The concept of consumer's surplus was evolved by _____.

A. Richard Gill
B. John Keynes
C. Douglas Irwin
D. Alfred Marshall

Ans. D

Sol. • The concept of consumer's surplus was evolved by Alfred Marshall.

• Consumer Surplus is the difference between the price that consumers pay and the price that they are willing to pay.

• He was also known as one of the founders of neoclassical economics.

58. Which region is known for its clay rich swamps and thick forests?

A. Bhabhar
B. Khadar
C. Terai
D. Bangar

Ans. C

Sol. • Terai plain lowland belt is characterised by tall grasslands, scrub savannah, sal forests and clay rich swamps. Jim Corbet National Park, Kaziranga National Park lies in Terai Regions.

• The thickness of terai region varies between 15-30 kms.

• This is also the region in which the rivers again reappear on surface.

• Terai region is suitable for cultivation of Sugarcane, rice and wheat.

59. Who was the prime minister at the time of nationalisation of 14 major commercial banks?

A. Rajiv Gandhi
B. Manmohan Singh
C. Morarji Desai
D. Indira Gandhi

Ans. D

Sol. * Indira Gandhi was the prime minister at the time of nationalisation of 14 major commercial banks.

* The nationalisation of 14 banks was done on 19 July 1969.

* Indira Gandhi was elected as the first woman prime minister.

* The largest and the oldest bank which is still in existence is the State Bank of India.

60. Which among the following former cricketers has been elected unopposed as the President of BCCI in 2019?

A. Sourav Ganguly
B. Sunil Gavaskar
C. Dilip Vengsarkar
D. Sachin Tendulkar

Ans. A

Sol. • BCCI (Board of Control for Cricket in India) is the national governing body for cricket in India, which was formed in December 1928 as a society, under the Tamil Nadu Societies Registration Act.

• Former Indian Captain Sourav Ganguli has been appointed as BCCI's 39th president.

• The head office of BCCI is situated in Mumbai at Wankhade stadium.

61. Who won the Pritzker Architecture Prize, 2019?

A. Alejandro Aravena
B. Arata Isozaki
C. B V Doshi
D. Shigeru Ban

Ans. B

Sol. • Arata Isozaki won the Pritzker Architecture Prize 2019.

• The ceremony was held on 24 May 2019. The award was constituted by Pritzker family of Chicago through their Hyatt Foundation in 1979.

• The motive of this Architecture Prize is to honor a living architect or architects whose built work demonstrates a combination of talent, vision and commitment.

62. Which of the following groups has the highest electron affinity?

A. Oxygen family
B. Halogens
C. Nitrogen group
D. Lanthanides

Ans. B

Sol. Halogens have the highest electron affinity.

• Electron affinity is basically the ability of an atom to accept an electron and gets converted into a negatively charged ion.

• Generally it increases going left to right across a period and decreases going down the group.

• Chlorine and Fluorine are the most high electron affinity atoms.

63. Who became the youngest Guru of Sikhism?

A. Guru Gobind Singh
B. Guru Tegh Bahadur
C. Guru Har Krishan
D. Gur Angad

Ans. C

Sol. * Guru Har Krishan was the eighth of the ten Sikh Gurus.
* At the age of 5, he became the youngest Guru in Sikhism on 7th October 1661.
* He succeeded his father, Guru Har Rai.
* He was also known as 'Bal Guru'.
* He sometimes spelled in Sikh literature as Hari Krishan Sahib.
* He is remembered in the Sikh tradition for saying "Baba Bakale".
* Guru Har Krishan Sahib had the shortest reign as Guru, lasting only 2 years, 5 months and 24 days.

64. Who was the first female Chief Minister in India?

A. Gayatri Devi
B. Sarojini Naidu
C. Sucheta Kriplani
D. None of above

Ans. C

Sol. Sucheta Kriplani was the first female Chief Minister of India.
• She became the Chief Minister of Uttar Pradesh from 1963 to 1967.
• In 1936, she married J. B. Kripalani, a prominent figure of the Indian National Congress.
• Note that Indira Gandhi was the first and the only female Prime Minister of India.

65. Plotter is which kind of a device?

A. Input
B. Output
C. Software
D. None of the above

Ans. B

Sol. Plotter is an output device.
• Plotter is a device for making vector graphics using other tools like pencil, pen etc.
• Plotters can work on very large sheets of paper while maintaining high resolution.
• They can print on a wide variety of flat materials including plywood, aluminium, sheet steel, cardboard, and plastic.

66. Which acid is present in Tamarind?

A. Tamrid Acid
B. Tartatic Acid
C. Tetra Acitic Acid
D. Formic Acid

Ans. B

Sol. • Tartaric acid is present in Tamarind.
• It is responsible for acidic nature of Tamarind.
• Tartaric acid is organic naturally occurring acid.
• It is also present in Bananas, Grapes, and Cirtus. The acid is added to foods as an antioxidant.

67. Which of the following ministries has launched a webinar "Dekho Apna Desh"?

A. Ministry of Defence
B. Ministry of AYUSH
C. Ministry of Tourism
D. Ministry of Health

Ans. C

Sol. * Ministry of Tourism has launched a webinar "Dekho Apna Desh".

* This will be the second webinar and Its named as Calcutta – A confluence of culture.

68. In which state, maximum length of the Ganga river lies?

A. Uttrakhand
B. Uttar Pradesh
C. Bihar
D. West Bengal

Ans. B

Sol. The Ganga River flows maximum distance in Uttar Pradesh.

* The total length of Ganga River is 2,525 kms.The distribution of Ganga flow statewise is-

A. Uttarakhand- 110 kms
B. Uttar Pradesh -1,450 kms
C. Bihar- 445 kms
D. West Bengal- 520 kms.

69. Daporijo Bridge was inaugurated in which of the following state or union territory ?

A. Assam
B. Ladakh
C. Jammu & Kashmir
D. Arunachal Pradesh

Ans. D

Sol. • Daporijo Bridge was inaugurated in Arunachal Pradesh state on 20 April 2020.

• This bridge was constructed by the Border Roads Organisation across the Subansiri River.

• The bridge over the Subansiri River in Arunachal Pradesh was constructed in less than a month.

70. Japanese Encephalitis (JE) is an infection of which body part?

A. Kidney
B. Immune system
C. Bones
D. Central Nervous System

Ans. D

Sol. • Japanese Encephalitis is an infection of the Central Nervous System caused by the Japanese encephalitis virus (JEV).

• This occurs 5 - 15 days after infection.

• It is a mosquito-borne infection that can cause fever, headache, seizures and in some cases death.

• JEV cannot transmit from one person to another.

71. Which part of the Indian Constitution deals with the citizenship provisions?

A. Part IV
B. Part III
C. Part V
D. Part II

Ans. D

Sol. • Articles 5 to 11 under Part II of the Constitution deals with the citizenship provisions.
• This part does not define the term 'citizen' but it only identifies the persons who became citizens of India at its commencement.
• It empowers the Parliament to enact law to provide for such matters and any other matter relating to citizenship. Accordingly the Parliament has enacted the Citizenship Act, 1955, which has been amended many times.

72. Which court serves the purpose of resolving issues between two parties amicably by way of compromise?

A. District Court
B. Lok Adalat
C. High Court
D. None of these

Ans. B

Sol. • Based on the alternative dispute resolution, Lok Adalat serves the purpose of resolving issues between two parties amicably by way of compromise.
• The Lok Adalat is organized by the High Court Legal Services Committee, District Legal Services Authority and Taluk Legal Services Committee.

73. By which name/ names is our country mentioned in the Constitution?

A. Bharat Only
B. India and Hindustan
C. India, Bharat and Hindustan
D. India and Bharat

Ans. D

Sol. • The official names as set down in article 1 of the Indian constitution are: India (English) and Bharat (Hindi).
• Bharat was selected as the name of the country of India in 1950.

74. How many states of India share border with Myanmar?

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

Ans. D

Sol. • The four northeast Indian states share border with Myanmar.
• These states share 1,643 km border with Myanmar.
• These 4 states are Arunachal Pradesh, Nagaland (215 Km), Mizoram (510 Km) and Manipur (398 Km).
• Arunachal Pradesh (520 Km) shares longest border with Myanmar.
• Myanmar shares its border with India, China, Bangladesh, Thailand and Laos.

75. The viscosity can be considered as an internal _____ of the fluid in the motion.

A. Friction
B. Velocity
C. Stress
D. None

Ans. A

Sol. • The viscosity can be considered as an Internal Friction of the fluid in the motion.
• Viscosity is a measure of a fluid's resistance to flow.
• A fluid with large viscosity resists motion because its molecular makeup gives it a lot of internal friction.

76. Which of the following institute researchers are developing magnetic Random Access Memory ?

A. IIT Mandi
B. IIT Delhi
C. IIT Hyderabad
D. IIT Shillong

Ans. A

Sol. • IIT Mandi researchers are developing Magnetic Random Access Memory.
• Magnetic Random Access Memory is much faster than the current technology and offers unlimited read and write cycles.
• It is an engineering and technology university located in Mandi district, Himachal Pradesh.

77. Bhitar Gaon temple is located at _____.

A. UP
B. Orissa
C. MP
D. Maharashtra

Ans. A

Sol. * Bhitargaon Temple is located at Kanpur district, Uttar Pradesh.
* It was Built in the 5th century during the Gupta period, it is the among the oldest Nagara style temple with a roof and a high shikhara

78. What is the full form of MPEG?

A. Moving Picture Expert Group
B. Moving Pixel Expert Grid
C. Mix Picture Expert Group
D. Mail Proceed Expert Grid

Ans. A

Sol. • The full form of MPEG is Moving Picture Expert Group.
• Moving Picture Expert Group is a working group of authorities for audio and video compression and transmission. Hiroshi Yasuda established it in 1988.
• The MPEG standards consist of different Parts. Each part covers a certain aspect of the whole specification.

79. Which of the following becomes the 1st company to begin supply of BS-VI fuel across India?

A. Indian Oil Corporation
B. Bharat Petroleum
C. Reliance Petroleum
D. All of them

Ans. A

Sol. • Indian Oil Corporation becomes the 1st company to begin supply of BS-VI fuel across India.
• The deadline had been set 1 april for starting the supply of Euro-VI emission compliant fuels by Indian Government.
• BS-VI has a sulphur content of just 10 ppm and emission standards are as good as CNG.

80. The quintessence of Gandhian thought is:

A. Satyagraha
B. metaphysics
C. spiritualism
D. moksha

Ans. A

Sol. According to Stanley E. Jones, Satyagraha is the totality or quintessence of Gandhian thought.

Gandhi introduced a new idea to the world - the philosophy of devotion to truth, remaining firm on the truth and resisting untruth actively but nonviolently. This is the meaning of Satyagraha, the basis of gandhian thought.

81. Which was the first country to print books?

A. India
B. Japan
C. Indonesia
D. China

Ans. D

Sol.
- Like paper, the Chinese also invented the art of printing.
- They used to dig wood pieces, letters, words and designs.
- He used pieces of wood, letters, words and designs.
- By 1430, the printing of books had begun in Europe.

82. The book 'The Glass Palace' is written by _____.

A. Amitav Ghosh
B. Anita Desai
C. Kiran Desai
D. None

Ans. A

Sol.
- The book 'the Glass Palace' is written by Amitav Ghosh.
- The novel is set in Burma, Bengal, India, and Malaya and give information about british invasion and fall of Konbaung Dynasty in Mandalay.

83. When is Indian Coast Guard Day celebrated?

A. 5 February
B. 1 February
C. 8 February
D. 12 February

Ans. B

Sol.
- Indian Coast Guard Day is celebrated every year on 1 February in India.
- The Indian Coast Guard was formally established on 18 August 1978 by the Coast Guard Act, 1978 of the Parliament of India as an independent Armed force of India.
- The Interim Indian Coast Guard was established on 1 February 1977 to prevent smuggling of sea freight.
- It operates under the Ministry of Defence.

84. Who wrote the book 'India Divided'?

A. VD Savarkar
B. MK Gandhi
C. Dinbandhu Mitra
D. Rajendra Prasad

Ans. D

Sol. Rajendra Prasad wrote the book 'India Divided'.

- Rajendra Prasad was the only president of India to serve two terms of President.
- Other major books of Rajendra Prasad are- Portrait of a President and Revival.
- He was awarded Bharat Ratan in 1962.

85. Which among the following become the first state to get geotag community kitchens ?

A. Haryana
B. Maharashtra
C. Rajasthan
D. Uttar Pradesh

Ans. D

Sol. • Uttar Pradesh became the first state to get geotag community kitchens.

• The kitchen produces 12 lakh food packets per day.

• An application has been developed by the Remote Sensing Application Centre to learn about the location of the community Kitchens.

86. The Indian National Congress session of September 1920 was held at _____.

A. Lucknow
B. Calcutta
C. Nagpur
D. Madras

Ans. B

Sol. * The Indian National Congress session of September 1920 was held at Calcutta.

* In this session, Mahatma Gandhi moved the Non cooperation resolution.

* It was presided by Lala Lajpat Rai.

87. Which organelle of cell produces ATP molecule?

A. Golgi Bodies
B. Mitochondria
C. Lysosomes
D. Cell Membrane

Ans. B

Sol. Mitochondria produce energy-rich molecule adenosine triphosphate (ATP).

- That's why it is called as Energy house of cell.
- ATP of Adenosine Triphosphate is also known as Energy currency of body.
- The mitochondrion is different from most other organelles because it has its own circular DNA and reproduces independently of the cell in which it is found.

88. Who invaded India during Muhammad Shah Rangila' s reign?

A. Sherashah Suri
B. Nadir Shah
C. Sahadat Khan
D. Mirza Shah

Ans. B

Sol. * Nadir Shah invaded India during the reign of Muhammad Shah.

* The battle of Karnal was fought on 24 February 1739 AD between the Mughal emperor Muhammad Shah and Nadirshah.

* Nadir Shah was the Shah of Persia (1736–47).

* He was the founder of the Afsharid dynasty of Persia.

89. Who won the "World Game Athlete of the Year, 2019"?

A. Rani Rampal
B. Bajarng Punia
C. Hima Das
D. Dutee Chand

Ans. A

Sol. • Rani Rampal won the "World Game Athlete of the Year, 2019".

• She was the first hockey player in the world to receive this title and she is also called Queen of Indian Hockey.

• The award is given to a player who is outstanding in terms of social concern, performance and good behavior.

90. Which hormone is also known as growth hormone?

A. Thyroid stimulating Hormone
B. Somatotropic Hormone
C. Gonade Tropic Hormone
D. Antidiuretic Hormone

Ans. B

Sol. • STH (Somatotropic Hormone) is also known as growth hormone.

• It stimulates growth, cell regeneration and cell reproduction.

• GH (Growth Hormone) also stimulates production of IGF – 1 and increases the concentration of glucose and free fatty acids.

91. Which International Organization has launched the Global Research Forum against Coronavirus outbreak?

A. European Union
B. World Bank
C. UNICEF
D. WHO

Ans. D

Sol. • World Health Organization (WHO) has launched the Global Research Forum against Coronavirus outbreak.

• A two-day global research and innovation forum was launched on February 12, 2020.

• The forum was organized by WHO along with Global Research Collaboration for Infectious Disease Preparedness.

• This forum has been funded by the Bill & Melinda Gates Foundation.

92. What is the total momentum of the bullet and the gun before firing?

A. 0 metres/sec
B. 0.5 metres/sec
C. 1 metres/sec
D. 2 metres/sec

Ans. A

Sol. • The gun and the bullet are both at rest, so the momenta (mv) of the gun and the bullet are both zero.

• So, the total momentum of the system before the bullet is fired is zero.

93. Which of the following is appointed as secretary to the President of India ?

A. Ajay Bhadoo
B. Kapil Dev Tripathi
C. Sanjay Kothari Singh
D. Randhir Kumar Jaiswal

Ans. B

Sol. • Kapil Dev Tripathi is appointed as secretary to the President of India.
• He is at present the chairman of the Public Enterprises Selection Board.
• He is appointed secretary by the Appointments Committee of the cabinet headed by Prime Minister Narendra Modi.

94. A nuclear reactor works through _____?

A. Uncontrolled chain reaction
B. Controlled chain reaction
C. Nuclear fusion
D. Spontaneous fission

Ans. B

Sol. • A nuclear reactor works through controlled chain reaction.
• A controlled chain reaction prevents the chain reaction from becoming violent.
• A nuclear reactor is a powerful device wherein produced nuclear energy is utilized.

95. India's first mission to moon was launched in which year?

A. 2008
B. 1998
C. 1969
D. 2005

Ans. A

Sol. • Chandrayaan-1 was India's first mission to the moon.
• It was launched by the Indian Space Research Organisation (ISRO) in October 2008.
• This mission was launched on 22nd October 2008 from Satish Dhawan Space Centre, at Sriharikota.
• It reached the moon on 8th November, 2008.

96. Kalsubai peak is in which of the following mountain ranges?

A. Western Ghats
B. Eastern Ghats
C. Himalayas
D. Aravalli

Ans. A

Sol. • Kalsubai peak is in Western Ghats Range.
• It is the highest peak of Maharashtra.
• It is 1646 mt high and consists mainly basaltic rock.
• Kalsubai Temple is located on this peak.

97. The Third Round Table Conference was held in the year _____.

A. 1932
B. 1931
C. 1933
D. 1930

Ans. A

Sol. • From 1930-32 there were three Round Table Conferences were held by British to negotiate with Indian leaders-

• First Round Table Conference -1930

58 political leaders participated but Indian National Congress did not participate.

• Second Round Table Conference- Setp-Dec, 1931

Indian National Congress participated only in this conference.

Other leaders who attended - BR Ambedkar, Jinnah, Sarojini Naidu, Princely states etc.

• Third Round Table Conference – Nov-Dec, 1932

Only 46 delegates attended it, no fruitful outcomes came out of it.

98. Thermite reactions use ..... as reducing agent?

A. Iron Oxide
B. Aluminium powder
C. Silver chloride
D. Zinc powder

Ans. B

Sol. Thermite reactions use Aluminium powder as a reducing agent.

• The reduction of a metal oxide to form metal by using aluminium powder as a reducing agent is called a thermite reaction.

• Thermite reactions are exothermic reactions.

• Production of Iron by reaction of iron oxide and aluminium powder is best ex. Of thermite reaction.

99. G20 is to be held in 2020 in_____.

A. New Delhi
B. Tokyo
C. Beijing
D. Riyadh

Ans. D

Sol. • G20 is to be held in 2020 in Riyadh.

• It will be the fifteen meeting of G20 which will be held on 21–22 November 2020.

• Saudi Arabia's first participation in the G20 meetings was in 2008.

• Riyadh is the capital of South Arabia.

100. A biofortified variety of carrot called "Madhuban" Gajar has been developed by scientists of which of the following states ?

A. Punjab
B. Gujarat
C. Maharashtra
D. Karnataka

Ans. B

Sol. • The farmer scientist from Gujarat has developed a biofortified variety of carrot called "Madhuban Gajar".

• This variety of carrot has high β-carotene and iron content.

• The name of farmer scientist is Shri Vallabhai Vashrambhai Marvaniyawas and he was also awarded with a National Award by the President of India.

101. Centre of buoyancy is defined as

A. Point of intersection of buoyant force and centre line of the body

B. centre of gravity of the body

C. Centroid of displaced volume fluid

D. Mid point between CG and metacentre

Ans. C

Sol. Centre of buoyancy is defined as the point ,through which the force of buoyancy is supposed to act.As the force of buoyancy is a vertical force and is equal to the weight of the fluid displaced by the body,the centre of buoyancy will be the centre of gravity of the fluid displaced.

102. Which of the following is the reason for the Cavitation ?

A. Pressure rises above vapour pressure

B. Pressure falls below atmospheric pressure

C. Pressure falls below vapour pressure

D. Pressure rises above atmospheric pressure

Ans. C

Sol. Cavitation is defined as the phenomenon of formation of vapour bubbles of a flowing liquid in a region where the pressure of the liquid falls below its vapour pressure and the sudden collapsing of these vapour bubbles in a region of high pressure. Hence º Cavitation occurs due to pressure falling below vapour pressure.

103. A multiple disc clutch carries 7 discs on driving shaft and 8 discs on driven shaft. The pairs of contact surfaces are

A. 14 B. 11

C. 9 D. 18

Ans. A

Sol. Number of disc on driving shaft = 7

Number of disc on driven shaft = 8

No. of active plates = 7 + 8 - 1 = 14

104. The cycle generally used for petrol engine is

A. Otto cycle B. Dual cycle

C. Carnot cycle D. Brayton cycle

Ans. A

Sol. * Petrol engine works on Otto cycle in which heat addition and rejection take place at constant volumes.

*Diesel engine works on Diesel cycle.

*Gas power plant works on Brayton cycle and carnot cycle is the ideal benchmark for all the cycles.

105. If the velocity vector in a two-dimensional flow field is given by V = y i+ (x+4y)j, then the vorticity vector in z-direction will be

A. y^2j B. zero

C. 6yk D. -4x k

Ans. B

Sol. Given,

Twice the value of rotation about any axis is called as vorticity along that axis.

thus the equation for vorticity along the axis is

velocity vector = V= y i+ (x+4y)j,

u= y,

v= (x+4y)

$$\Omega_z = 2\,\omega_z = \left(\frac{\partial u}{\partial x} - \frac{\partial u}{\partial y}\right)$$

$$\frac{\partial u}{\partial x} = 1$$

$$\frac{\partial u}{\partial y} = 1$$

$$\Omega_z = \left(\frac{\partial u}{\partial x} - \frac{\partial u}{\partial y}\right)$$

$\Omega_z = (1 - 1) = 0$

106. Match **List-I** (type of gear failure) with **List-II** (Reasons) select the correct answer using the code given below the lists:

List-I

A). Scoring

B). Pitting

C). Scuffing

D). Plastic flow

List-II

1). Oil film breakage

2). Yielding of surface under heavy loads

3). Cyclic loads causing high surfaces stress

4). Insufficient lubrication

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

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

Ans. C

Sol. * Scoring is Lubrication Failure inadequate lubrication with high tooth load and poor surface finish results in breakdown of oil film and causes metal to metal contact which is called scuffing or galling.

*Pitting=Cyclic loads causing high surfaces stress

* Scuffing=Oil film breakage

*Plastic flow = Yielding of surface under heavy loads

107. The static deflection of a shaft under a flywheel is 4 mm. Take g = 10 m/s^2. What is the critical speed in rad/s?

A. 50 B. 20

C. 10 D. 5

Ans. A

Sol. Given,

static deflection of a shaft = 4mm= 0.004 m

Critical speed in rad/s = $\sqrt{\frac{g}{\delta}}$

$= \sqrt{\frac{10}{4\times10^{-3}}} = 50_{rad/sec}$

108. What is the true strain of a body if the final length is 20 mm and the initial length is 10mm?

A. 2 B. 1.71

C. 0.693 D. 1.31

Ans. C

Sol. True Strain,

$\varepsilon_T = 1n(1+\varepsilon_e)$

$\varepsilon_e = \frac{\Delta L}{L} = \frac{(20-10)}{10} = 1$

True strain = 1n(1 + 1) = 1n(2) = 0.693

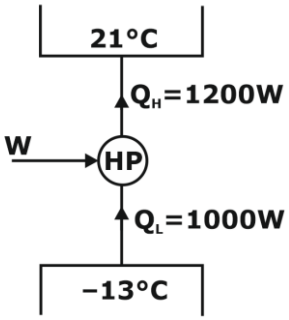
109. A heat pump is working between the temperature limits of 27°C and −13°C. The rate of heat addition and heat rejection are 1000 W and 1200 W. What will be the COP of heat pump?

A. 5 B. 6

C. 12 D. 7.5

Ans. B

Sol.



T_H = 27°C = 300k, T_L = -13°C = 260 k

Q_H = 1200 W Q_L = 1000 W

$$(COP)_{HP} = \frac{Q_H}{Q_H - Q_L} = \frac{1200}{1200-1000} = \frac{1200}{200}$$

$(COP)_{HP}$ = 6

110. Mean temperature of heat addition _____ due to Regeneration

A. Decreases
B. not effected
C. Increases
D. varied exponentially

Ans. C

Sol. Mean temperature of heat addition is average temperature at which heat is supplied to the working substance.

In regeneration ,the supply of heat at low temperatures is avoided ,hence the mean temperature of heat addition increases.

111. The temperature distribution in Heat conduction through a hollow cylinder is

A. Parabolic
B. Linear
C. Logarithmic
D. Elliptical

Ans. C

Sol. In hollow cylinder temperature distribution is logarithmic and temperature at any point in the cylinder can be expressed as a function of radius only.

112. Which of the following statement is correct regarding regeneration in brayton cycle?

A. Both Net work output and heat supplied increases
B. Net work output remains same and heat supplied decreases
C. Both Net work output and heat supplied decreases
D. Net work output decreases and heat supplied increases

Ans. B

Sol. In case of regeneration in brayton cycle, Net work output remains same whereas both heat supplied and heat rejected decreases

113. For the case of sensible heating of air, the coil efficiency is given by: (B.P.F = Bypass factor)

A. (B.P.F)−1

B. 1 − (B.P.F)

C. $\frac{1}{(B.P.F)}$

D. 1 + (B.P.F)

Ans. B

Sol. B.P.F = Bypass factor

$$B.P.F. = \left|\frac{\text{Temperature drop or increase not achieved}}{\text{Temperature drop or increase that could be achieved ideally}}\right|$$

$\eta + B.\ P.\ F. = 1$

$\eta = 1 - (B.\ P.\ F.)$

114. Match list-I (Surface with orientations) with List-II (Equivalent emissivity) and select the correct answer using the codes given below the lists :

List-I

A- Infinite parallel planes

B- Body 1 completely enclosed by body 2 but body 1 is very small

C- Radiation exchange between two small gray bodies.

D- Two concentric cylinders with large lengths.

List-II

1- ϵ_1

2- $\frac{1}{\frac{1}{\varepsilon_1}+\frac{1}{\varepsilon_2}-1}$

3- $\frac{1}{\frac{1}{\varepsilon_1}+\left(\frac{A_1}{A_2}\right)\left(\frac{1}{\varepsilon_2}-1\right)}$

4- $\epsilon_1\epsilon_2$

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

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

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

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

Ans. C

Sol. A- Infinite parallel planes=

$$\frac{1}{\frac{1}{\varepsilon_1}+\frac{1}{\varepsilon_2}-1}$$

B- Body 1 completely enclosed by body 2 but body 1 is very small = ϵ_1

C- Radiation exchange between two small gray bodies = $\epsilon_1\epsilon_2$

D- Two concentric cylinders with large lengths =

$$\frac{1}{\frac{1}{\varepsilon_1}+\left(\frac{A_1}{A_2}\right)\left(\frac{1}{\varepsilon_2}-1\right)}$$

115. What will be the magnitude of the force P needed to just impend the motion of the block? (If the weight of the block is 80N and coefficient of friction is 0.4)

A. 80N
B. 0N
C. 32N
D. 112N

Ans. C

Sol. The magnitude of the force P needed to just impend the motion of the block will be equal to the limiting friction or maximum static friction –

$P = f_r = \mu N$

$P = 0.4 \times 80 \rightarrow 32$ N (N=Mg =80 N)

116. A fixed beam of length L is having concentrated load W at the midpoint. Then deflection of the beam, if moment of inertia I and young's modulus E is given

A. $\frac{wL^3}{3EI}$
B. $\frac{wL_3}{192El}$
C. $\frac{WL^3}{8EI}$
D. None of these

Ans. B

Sol. * For fixed beam deflection is $\frac{WL_3}{192El}$

Where W is concentrated load acting at the midpoint of the beam.

117. If a heat engine produces work without the consumption of energy, then what kind of machine is this?

A. Perpetual motion machine of first kind (PMM1)
B. Perpetual motion machine of second kind (PMM2)
C. Perpetual motion machine of third kind (PMM3)
D. None of these

Ans. A

Sol. * This kind of device is impossible.

* PMM1 is a hypothetical engine which develops work without receiving the heat energy.

118. Sensible heat factor is given by ,(S.H. - Sensible Heat, L.H. - Latent Heat)

A. $\frac{S.H.}{S.H. + L.H.}$
B. $\frac{S.H. + L.H}{S.H.}$
C. $\frac{S.H.}{L.H. - S.H.}$
D. $\frac{L.H - S.H.}{S.H.}$

Ans. A

Sol. Sensible heat factor = $\frac{\text{Sensible Heat}}{\text{Total Heat}} = \frac{\text{S.H.}}{\text{S.H.} + \text{L.H.}}$

SHF will be 1 for Sensible heating.

119. A straight bimetallic strip made up of aluminium and steel is heated uniformly by passing current through a coil wounded over it. What can be said about the nature of stress induced?

A. Tension in both

B. Tension in aluminium, compression in steel

C. Compression in both

D. Compression in aluminium, tension in steel

Ans. D

Sol. The thermal expansion coefficient of aluminium bar is more than Steel bar, thus while heating, aluminium bar will try to expand more as compare to the steel bar. But since both are joined rigidly,the expansion in both have to be same ,the true expansion in aluminium will be somewhat less than its free expansion.So compressive thermal stresses will develop in aluminium and Tensile Thermal stress will develop in Steel bar.

120. "$C_2H_2F_4$" can be written as

A. R-134

B. R-1150

C. R-22

D. R 113

Ans. A

Sol. $C_2H_2F_4 \Rightarrow$ It is a saturated hydrocarbon

comparing it with $C_mH_nF_pCl_q$

m = 2, n = 2, p = 4

Thus refrigerant name = R– (m – 1)(n + 1) P

R– (2 – 1) (2 + 1) (4)

R–134

121. In Brayton Cycle, the work ratio is 0.65. What is the back work ratio of this Brayton Cycle?

A. 2.53

B. 0.65

C. 0.35

D. 1.53

Ans. C

Sol. For a Brayton Cycle:

Work ratio (r_w)+ Back work ratio (r_{bw}) = 1

Therefore:

$r_{bw} = 1 - r_w = 1 - 0.65 = 0.35$

122. The use of a draft tube in a reaction type water turbine helps to

A. Prevent air from entering

B. Increase the flow rate

C. Convert the kinetic energy to pressure energy

D. Eliminate eddies in the downstream

Ans. C

Sol. The draft tube has two purpose as follows:

(i) It permrts a negative or suction head to be established at the runner exit, thus making it possible to install the turbine above the tail race level without loss of head.

(ii) It converts a large proportion of velocity energy rejected from the runner into useful pressure energy.

123. The mixture of gaseous air and liquid air is

A. Pure Substance
B. Not a pure substance
C. Both (a) and (b)
D. None of these

Ans. B

Sol. Air and liquid air both are pure substance but the chemical composition of both compounds is different. So, the mixture of air and liquid air is not a pure substance.

124. Froude number is significant in

A. supersonics, as with projectile and jet propulsion

B. full immersion or completely enclosed flow, as with pipes, aircrafts wings, nozzles etc.,

C. simultaneous motion through two fluids where there is a surface of discontinuity, gravity forces, and wave making effect, as with ship's hulls

D. all of these

Ans. C

Sol. * Froude number comes in play where the gravity is dominant and surface activities are happening.

* Hydraulic structures with free surface flow as in Spillways.

* free surface flow as in flow in canals, streams and rivers.

125. A turning operation is carried out on lathe machine. The thrust force in turning will increase with increase in

A. side cutting edge angle
B. rake angle
C. nose radius of tool
D. End cutting edge angle

Ans. A

Sol. We know that thrust force of turning is given by

$$F_y = F_t \cos\lambda \cos\lambda = F_t \sin C_s$$

Where,

F_y = thrust force of turning

F_t = total thrust force in 2D

C_S = side cutting edge angle

126. Which kind of distribution is used in PERT for activity and project?

A. Normal & Beta
B. Beta & Normal
C. Normal & Normal
D. Beta & Beta

Ans. B

Sol. In PERT for Activity= Beta Distribution

In PERT for Project = Normal Distribution

127. What is the process of removing metal by a milling cutter which is rotated against the direction of travel of the work piece, called?

A. Down milling
B. Up milling
C. End milling
D. Face milling

Ans. B

Sol. **Up milling**: when cutting and feed motion are in opposite direction then it is called up milling. It is safer than down milling.

Down milling: When cutting and feed motion are in same direction then it is called down milling. In down milling there is tendency of the job being dragged into the cutter. Hence it is not safer than up milling. However down milling results in better surface finish and longer tool life.

128. The correct Sequence for the Cu, Fe, Steel, Ice in increasing order of their thermal conductivity is

A. Ice< Steel< Fe< Cu
B. Cu< Fe< Steel< Ice
C. Fe< Cu< Steel< Ice
D. Steel< Ice< Fe< Cu

Ans. A

Sol. Increasing order of their thermal conductivity

Ice< Steel< Fe< Cu

Material	Thermal Conductivity
Ice	1.2
Steel	30-50
Cu	387
Fe	100

129. Orsat meter is used for

A. Mass flow of the flue gases
B. Volumetric analysis of the flue gases
C. Gravimetric analysis of the flue gases
D. Measuring smoke density

Ans. B

Sol. Orsat meter is used for Volumetric analysis of the flue gases.

So, the correct option is (b).

130. Which of the following is a Water tube boiler?

A. Lancashire boiler
B. Cornish boiler
C. Locomotive boiler
D. Babcock and Wilcox boiler

Ans. D

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

131. The Wet Bulb Depression is zero when relative humidity is:

A. 0
B. 0.5
C. 0.75
D. 1.0

Ans. D

Sol. By definition,

Wet Bulb Depression = WBT - DBT.

Therefore, WBD = 0 means WBT = DBT, which happens when air is completely saturated. i.e. when RH = 1.0

132. A closed system rejects 80 kJ heat and work done by the system is 80 kJ. The change in internal energy will be:

A. 0 kJ
B. -160 kJ
C. 160 kJ
D. 40 kJ

Ans. B

Sol. For closed system:

$\delta Q = dU + \delta W$

$\Rightarrow -80 = dU + 80$

$\Rightarrow dU = -160$ kJ

So, the correct option is (b).

133. Principal strains at a point are $+100\times10^{-6}$ and -200×10^{-6}. What is the maximum shear strain at the point?

A. 300×10^{-6}
B. 200×10^{-6}
C. 150×10^{-6}
D. 100×10^{-6}

Ans. A

Sol. Maximum shear strain

Principal strains at a point are $+100\times10^{-6}$ and -200×10^{-6}

$\epsilon_1 = 100 \times 10^{-6}$

$\epsilon_2 = -200 \times 10^{-6}$

$$\frac{\gamma}{2} = \frac{\varepsilon_1 - \varepsilon_2}{2}$$

$\gamma = 100 \times 10^{-6} - (-200 \times 10^{-6})$

$\gamma = 300 \times 10^{-6}$

134. Delta iron exists in the temperature range of

A. 0^0C to 768^0C
B. 768^0C to 900^0C
C. 900^0C to 1400^0C
D. 1400^0C to 1530^0C

Ans. D

Sol. Delta iron, characterized by a body-centred cubic crystal structure, is stable above a temperature of 1,390 °C (2,534 °F). Below this temperature there is a transition to gamma iron, which has a face-centred cubic (or cubic close-packed) structure and is paramagnetic.

135. Atomic Packing fraction (In percentage) of face-centered cubic structure is equal to

A. 74
B. 52
C. 68
D. 66

Ans. A

Sol. Atomic Packing fraction of face-centered cubic structure is equal to 74%

136. Supercharging is the process of

A. supplying the intake of an engine with air at a density greater than the density of the surrounding atmosphere
B. providing forced cooing air
C. injecting excess fuel for raising more load
D. supplying compressed air to remove combustion products fully

Ans. A

Sol. Supercharging increases the pressure or density of air supplied to an internal combustion engine. This gives each intake cycle of the engine more oxygen, letting it burn more fuel and do more work, thus increasing power.

137. Operation of punching a pattern of holes in similar or continuous row is

A. Lancing
B. Perforating
C. Beading
D. Hemming

Ans. B

Sol. * Perforating = Operation of punching a pattern of holes in similar or continuous row is
* Beading = used to form shallow, round raised recessed troughs of uniform width.
* Hemming = In this, the edges of sheets are turned over to provide stiffness and a smooth edge.

138. The cycle generally used for gas turbines is:

A. Otto cycle
B. Brayton cycle
C. Carnot cycle
D. Dual cycle

Ans. B

Sol. Gas turbine works on a work producing cycle known as Brayton cycle in which working substance remains in single phase and commonly known working substances is Methane.

139. A reversible engine operates between temperature T_1 and T_2. The energy rejected by this engine acts as an input for another reversible engine at temperature T_2, which rejects to a reservoir at temperature T_3. What is the relation between T_1, T_2 and T_3? (Given that the efficiency of both reversible heat engine is same)

A. $T_2 = \frac{T_1 + T_3}{2}$

B. $T_2 = \sqrt{T_1^2 + T_3^2}$

C. $T_2 = \sqrt{T_1 T_3}$

D. $T_2 = \frac{T_1 - T_3}{2}$

Ans. C

Sol. Case -1 Heat engine operates between temperature T_1 and T_2

$$\eta_1 = 1 - \frac{T_2}{T_1}$$

Case -2 Heat engine operates between temperature T_2 and T_3

$$\eta_2 = 1 - \frac{T_3}{T_2}$$

* Since the efficiency of both reversible heat engine is same therefore

$\eta_1 = \eta_2$

$1-(T_2/T_1) = 1 - (T_3/T_2)$

$$\frac{T_1 - T_2}{T_1} = \frac{T_2 - T_3}{T_2}$$

$T_2 = T_1 \times T_3$

$$T_2 = \sqrt{T_1 T_3}$$

140. Match **List-I** (Type of Gear/Gear Train) with **List-II** (different Usage and drive) and select the correct answer using the code given below the lists:

List-I

A) Epicyclic gear train

B) Bevel Gear

C) Worm and worm gear

D) Herringbone Gear

List-II

1) Reduces end thrust

2) Low gear ratio

3) Drives non-parallel non-intersecting shafts

4) Drives non-parallel intersecting shafts

5) High gear ratio

A. A-5; B-4; C-3; D-1
B. A-2; B-3; C-4; D-5
C. A-5; B-3; C-4; D-1
D. A-2; B-4; C-3; D-5

Ans. A

Sol. 1) Epicycle gear train → high gear ratio

2) Bevel gear → Drives non-parallel intersecting shafts

3) Worm-worm gear → Drives non- parallel, non- intersecting shafts

4) Herringbone gear → Reduce end thrust.

141. Sensitiveness of governor is given by:

A. $\frac{\text{Range of speed}}{\text{Mean speed}}$
B. $\frac{\text{Mean speed}}{\text{Range of speed}}$
C. $\frac{\text{Maximum speed}}{\text{Minimum speed}}$
D. $\frac{\text{Range of speed}}{2\times\text{Mean speed}}$

Ans. A

Sol. *Sensitiveness = (Range of speed)/(Mean speed)

$$\text{Sensitiveness} = \frac{2(N_1 - N_2)}{(N_1 + N_2)}$$

So, the correct option is (a).

142. E, G, K, and μ represent the elastic modulus, shear modulus, bulk modulus and Poisson's ratio respectively of a linearly elastic, isotropic and homogeneous material. To express the stress–strain relation completely for this material, at least

A. *E, G* and μ must be known
B. *E*, *K* and μ must be known
C. any two of the four must be known
D. All the four must be known

Ans. C

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

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

Here four unknown quantity and two equation.

Hence any two of the four must be known for Complete stress relationship

143. Consider the following statements:

1). The actual entry point through which the molten metal enters the mould cavity is called ingate.

2). Bottom gate in case of a mould creates favourable temperature gradient.

3). Sprue in case of a mould is made tapered to avoid air inclusion.

Which of the statements is/are correct?

A. 1 only
B. 1 and 2
C. 2 and 3
D. 1 and 3

Ans. D

Sol. * Ingates are openings through which molten metal enters the mould cavity.

* Bottom gates take some what higher time of filling and also generates an unfavourable temperature gradient.

* Spruce in case of a mould is made tapered to avoid air inclusion.

144. In a radial blade centrigugal compressor, the velocity of blade tip at outlet is 400 m/s and slip factor is 0.9. Assuming the absolute velocity at inlet to be axial, the work done per kg of flow is

A. 36 kJ B. 72 kJ

C. 144 kJ D. 360 kJ

Ans. C

Sol. Given,

Velocity of blade tip at outlet $=u_2= 400$ m/s

Slip factor = $\Psi = 0.9$

Work done /kg $= \psi u_2^2$

$$= \frac{0.9(400)^2}{10^3} = 144\text{kJ}$$

145. The pressure drop in a 100 mm diameter pipe is 50 kPa over a length of 10 m. The shear Stress at the pipe wall is.

A. 0.25kPa B. 0.125kPa

C. 0.50kPa D. 25.0kPa

Ans. B

Sol. Given,

$$\frac{dp}{dx} = \frac{50 \times 10^3}{10} = 5000 \frac{N}{m^3}$$

(Since pressure drop take place so negative pressure gradient)

Radius= 50 mm= 0.050 m

The standard expression for calculating shear stress at the wall is given by

$$\tau = \frac{-R\ dP}{2\ dx}$$

$$\tau = \frac{-0.050}{2}\left(\frac{-dP}{dx}\right)$$

$$= \frac{-0.050}{2}(-5000)$$

= 125 Pa

= 0.125 kPa

146. In a strained material, normal stresses on two mutually perpendicular planes are σ_x and σ_y (both alike) accompanied by a shear stress τ_{xy}. One of the principal stresses will be zero, only when

A. $\tau_{xy} = \frac{\sigma_x \times \sigma_y}{2}$

B. $\tau_{xy} = \sigma_x \times \sigma_y$

C. $\tau_{xy} = \sqrt{\sigma_x \times \sigma_y}$

D. $\tau_{xy} = \sqrt{\sigma^2 x + \sigma^2 y}$

Ans. C

Sol. Given,

If one of the principal stress = 0

$$\sigma_{1/2} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau xy^2}$$

σ_1 = maximum principle stress

σ_2 = minimum principle stress,

$\sigma_2 = 0$

$$\left(\frac{\sigma_x + \sigma_y}{2}\right) - \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau xy^2} = 0$$

after solving we get,

$$\tau_{xy} = \sqrt{\sigma_x \sigma_y}$$

147. In a car workshop the arrival rate is 5 per hr and the service rate was found to be 8 per hr. what is the waiting time in system?

A. 10 min

B. 20 min

C. 30 min

D. 40 min

Ans. B

Sol. Given,

Arrival rate (λ) = 5 Car/hr

Service rate (μ) = 8 Car/hr

Waiting time in System (W_S)

$$\therefore W_s = \frac{1}{(\mu - \lambda)} = \frac{1}{3}\text{hr} = \frac{60}{3}\text{min} = 20\,\text{min}$$

148. For a steady two-dimensional flow, the scalar components of the velocity field are u_x= -2x, u_y= 2y, u_z = 0 .what are the components of acceleration?

A. ax = 0, a_y = 0

B. a_x = 4x, a_y = 0

C. a_x = 0, a_y = 4y

D. a_x = 4x, a_y = 4_y

Ans. D

Sol. Given,

component of velocity in x-direction u_x= -2x

component of velocity in y-direction uy= 2y

component of velocity in z-direction u_z = 0

$$a_x = \frac{u\partial u}{\partial x} + \frac{u\partial u}{\partial_x} + \frac{w\partial u}{\partial_x} + \frac{\partial u}{\partial t}$$

$$a_x = (-2x) \times (-2) + 0 + 0 + 0$$

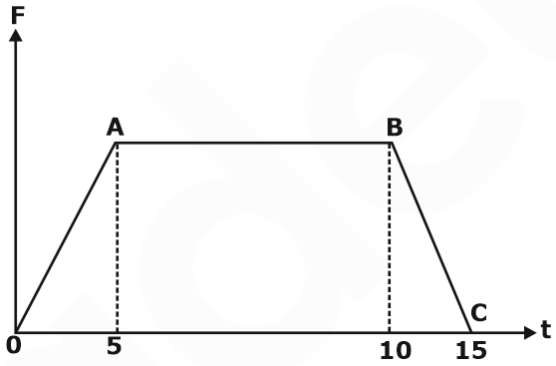
$$a_x = 4x$$

$$a_y = \frac{u\partial v}{\partial_x} + \frac{u\partial u}{\partial_y} + w\frac{\partial u}{\partial z} + \frac{\partial u}{\partial t}$$

a_y = (− 2x × 0) + 2y × 2 + 0 + 0

a_y = 4y

149. The following figure shows a graph of force vs time. The net impulse will be (Take Height of point A and B is 10 N)



A. 50 Ns

B. 100 Ns

C. 150 Ns

D. 200 Ns

Ans. B

Sol. Given,

Height of point A and B is 10 N

Net impulse = Area of curve

$$= \frac{1}{2} \times 5 \times 10 + 5 \times 10 + \frac{1}{2} \times 5 \times 10 = 100\text{Ns}$$

150. The thickness of laminar boundary layer at a distance 'X' from the leading edge over a flat varies as

A. X

B. $X^{1/2}$

C. $X^{1/5}$

D. $X^{4/5}$

Ans. B

Sol. Thickness of laminar boundary layer=

$$\delta = \frac{5x}{\sqrt{Re_x}}$$

$$Re_x = \frac{\rho V x}{\mu}$$

So

$$\delta \ \alpha \frac{x}{\sqrt{x}}$$

$$\delta \ \alpha \sqrt{x}$$

Where x is distance from leading edge of boundary layer.

151. The degree of Freedom of triple point of water is

A. 0 B. 1

C. 2 D. 3

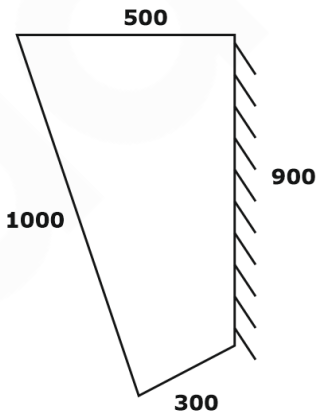
Ans. A

Sol. At triple point number of phases of water are 3. So, P=3 and there is only one component i.e. water (H_2O) so, C =1. Therefore, from Gibbs Phase rule we have

P + F = C + 2

∴ F = C + 2 – P = 3 – 3 = 0

152. What type of mechanism is shown in the diagram below?



A. Double rocker mechanism B. Crank rocker mechanism

C. Double crank mechanism D. Linkage is not planar

Ans. B

Sol. When the link next to the shortest link is fixed, the short link is able to rotate continuously and is called crank. The link opposite to it can only oscillate between limits and is called the rocker. In the given diagram, the link adjacent to the shortest link is fixed, thus crank rocker mechanism is obtained.

153. A ball of mass 2kg is revolved in a vertical circle at a speed of 5rad/s through a rope of nylon of length 0.5m. Calculate the maximum and the minimum tension in the rope. (Take g = 10m/s^2)

A. Max = 45N Min = 20N
B. Max = 20N Min = 0N
C. Max = 5N Min = 0N
D. Max = 45N Min = 5N

Ans. D

Sol. The maximum and minimum tension will occur in the rope at the bottom-most and the top-most point of the circle. Since, it is a vertical circle problem. Therefore, effect of weight of ball will be taken into account.

Maximum tension:

$T_{max} = mg + mr\omega^2$

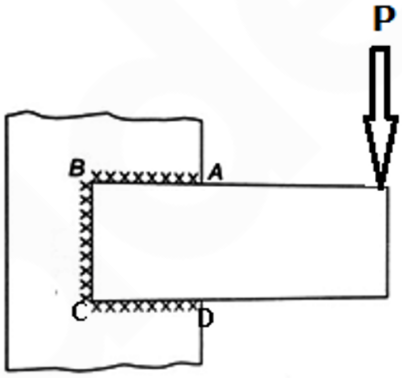
$T_{max} = 20 + 25 = 45N$

Minimum tension:

$T_{min} = mr\omega^2 - mg$

$T_{min} = 25 - 20 = 5N$

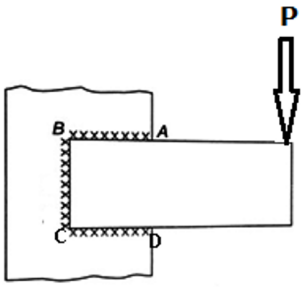
154. A compound fillet welded joint is loaded by P as shown. The maximum shearing stress occurs at point



A. A and D
B. B and D
C. A only
D. C only

Ans. A

Sol.



* Primary shear stress will be vertically upward

* Secondary shear stress will be anticlockwise and will be at some inclination from the vertical axis,

* Upward at A and D & downward at B and C. so at A and D combined stress will be high

155. Consider the following statements

The transmission of motion from a pinion to a meshing gear of involute profile is a case of

1) Pure rolling

2) Sliding with constant velocity of sliding

3) Sliding with time varying velocity of sliding

4) Rolling with some amount of sliding

Which of these statements are correct?

A. 3 and 4 only
B. 1 and 2 only
C. 2 and 3 only
D. 1, 2, 3 and 4

Ans. A

Sol. * Transmission of motion from a pinion to a meshing gear of involute profile is a case of Rolling with some amount of sliding.

* Velocity of sliding is given at any point as

$V_s = (\omega_1 + \omega_2) \times$ (distance of the point from pitch point)

Hence it keeps varying.

156. In a cooling tower, the minimum temperature to which water can be possibly cooled is known as

A. Dew point temperature of air
B. Wet bulb temperature of air
C. Dry bulb temperature of air
D. Ambient surrounding temperature

Ans. B

Sol. Dry bulb temperature (DBT):

Temp. of moist sir measured by a standard thermometer

Wet bulb temperature (WBT)

Temp. of moist sir measured by a thermometer covered with wetted wick or wet cloth.

Dew Point temperature (DPT):

If unsaturated moist air is cooled at constant pressure, then the temperature at which the moisture in the air begins to condense is known as dew-point temperature (DPT) of air

157. A shaft subjected to combined twisting moment T and bending moment M. What is the equivalent bending moment?

A. $\frac{1}{2}\left\{\sqrt{M^2 + T^2}\right\}$
B. $\sqrt{M^3 + T^2}$
C. $\frac{1}{2}\left(M + \sqrt{M^2 + T^2}\right)$
D. $M + \sqrt{M^3 + T^2}$

Ans. C

Sol. Bending moment (M) develop bending stress.

twisting moment (T) develop torsional shear stress

Equivalent bending moment,

$$\sigma_{eq} = \frac{\sigma_b}{2} + \sqrt{\left(\frac{\sigma_b}{2}\right)^2 + \tau^2}$$

$$\frac{32M_{eq}}{\pi D^3} = \frac{1}{2}\left(\frac{32M}{\pi D^3}\right) + \sqrt{\left(\frac{1}{2}\left(\frac{32M}{\pi D^3}\right)\right)^2 + \left(\frac{16T}{\pi D^3}\right)^2}$$

$$\frac{32M_{eq}}{\pi D^3} = \frac{16}{\pi D^3}\left(M + \sqrt{M^2 + T^2}\right)$$

$$M_{eq} = \frac{M + \sqrt{M^2 + T^2}}{2}$$

158. The microscopic mode of energy storage in a system includes

A. Kinetic energy
B. Potential energy
C. Internal energy
D. All of these

Ans. C

Sol. Mainly, there are two modes in which energy can be stored in a system:

(i) Macroscopic energy mode (includes kinetic energy, potential energy)

(ii) Microscopic energy mode (includes internal energy i.e. energy stored in the molecular structure of the substance)

159. If the pressure of water is raised from 1 atm to 3500 atm then, volume changes from 1000 m^3 to 120 m^3 then, bulk modulus of elasticity is approximately ?

A. 0.56 GPa
B. 0.397 GPa
C. 0.865 GPa
D. none of these

Ans. B

Sol. Given,

Pressure of water is raised from 1 atm to 3500 atm,

Volume changes from 1000 m^3 to 120 m^3

The bulk modulus of elasticity (K) of fluid is given as

$$K = -\frac{\text{Change in pressure}}{\frac{\text{change in volume}}{\text{original volume}}} = -\frac{dp}{dv/v}$$

$$K = \frac{-(3500-1)\times 10^5}{\frac{(120-1000)}{1000}} = 0.397 \text{ GPa}$$

160. If pressure ratio in Brayton cycle increases

A. the efficiency of the cycle increases

B. the efficiency of the cycle decreases

C. there is no any effect on the efficiency of the cycle

D. cannot say

Ans. A

Sol. With increase in pressure ratio in Brayton cycle the efficiency of the cycle increases

$$\eta = 1 - \frac{1}{r_p\left(\frac{\gamma - 1}{\gamma}\right)}$$

161. Modules of rigidity is the ratio of:

A. Axial stress to lateral strain

B. Linear stress to longitudinal strain

C. Shear stress to shear strain

D. Hydrostatic stress to volumetric strain

Ans. C

Sol. Modulus of rigidity is the ratio of shear stress to shear strain.

$$G = \frac{\tau}{\gamma}$$

G = Modulus of rigidity,

τ= Shear stress,

γ = Shear Strain

162. Line separating liquid phase from liquid and solid phase mixture is known as

A. Liquidus

B. Solidus

C. Tie line

D. None of the mentioned

Ans. A

Sol. Liquidus is the line separating liquid phase from liquid and solid phase mixture.

163. Match **List-I** (Forging/Technique) with **List-II** (Process) and select the correct answer using the code given below the lists:

List-I

A). Smith Forging

B). Drop Forging

C). Press Forging

D). Machine Forging

List-II

1. Material is only upset to get the desired shape
2. Carried out manually in open dies
3. Done in closed impression dies by hammers in blows
4. Done in closed impression dies by continuous squeezing force

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

Ans. A

Sol. **Smith Forging:** Carried out manually in open dies

Drop Forging: Done in closed impression dies by hammers in blows

Press forging: Done in closed impression dies by continuous squeezing force

Machine Forging: Material is only upset to get the desired shape

164. Consider the following statements:

Diesel knock can be reduced by

1). increasing the compression ratio.

2). increasing the engine speed.

3). increasing the injection retard.

4). decreasing the inlet air temperature.

Which of these statements are correct?

A. 2 and 4 only
B. 1, 2 and 3 only
C. 1 and 3 only
D. 1, 2, 3 and 4

Ans. C

Sol. Factors tending to reduce knocking in CI engine.

S.No.	Factors	
1	Self-ignition temperature of fuel	Low
2	Time lag or delay period for fuel	High
3	Compression ratio	High
4	Inlet temperature and pressure	High
5	Combustion chamber wall temp	High
6	Speed	Low
7	Cylinder size	Large

165. For a belt drive application, the difference between tensions on the slack & tight sides is 3000N. Determine the transmitted power in kW, if the belt speed is 15 m/s:

A. 45
B. 22.5
C. 90
D. 100

Ans. A

Sol. Given, $T_1 - T_2 = 3000N$

where, T_1, T_2 are tension on tight & slack sides respectively.

v is belt speed = 15 m/sec

$\therefore$ Power = $(T_1 - T_2)v$

$\therefore$ Power = $3000 \times 15 = 45000$ watt = 45 kW

166. A refrigeration plant uses a condenser with heat rejection ratio of 1.2. If the capacity of the plant is 210 kJ/min, then the value of the *COP* of the refrigeration plant is

A. 3 B. 5

C. 7 D. 9

Ans. B

Sol. $$HRR = \frac{Qc}{RE} = \frac{RE + W}{RE} = 1 + \frac{W}{RE}$$

$$HRR = 1 + \frac{1}{COP}$$

$$\text{Then, } 1.2 = 1 + \frac{1}{COP}$$

$\therefore$ COP = 5

167. Which one of the following welding processes consists of minimum heat affected zone (HAZ)?

A. Shielded Metal Arc Welding (SMAW)

B. Laser Beam Welding (LBW)

C. Ultrasonic Welding (USW)

D. Metal Inert Gas Welding (MIG)

Ans. B

Sol. In LBW, the waves are of single phase (coherent). Thus the laser beam is a high energy source of heat to melt, even evaporate, the joint for the fusion welding in laser beam welding.

168. Ratio of the pressure rise in rotor blades to the pressure rise in stages in an axial flow compressor is defined as

A. Degree of pressure B. Degree of reaction

C. Pressure ratio D. Reaction ratio

Ans. B

Sol. Degree of reaction can be defined as the ratio of the pressure rise in rotor blades to the pressure rise in stages in an axial flow compressor

$$\text{Degree of Reaction} = \frac{\text{Enthalpy drop in fixed blade}}{\text{Enthalpy drop in each stage (fixed + movig blade)}}$$

169. A rod of dimension 20 mm × 20 mm is carrying an axial tensile load of 10 kN. The tensile stress developed is _____.

A. 0.025 MPa
B. 0.25 MPa
C. 25 MPa
D. 250 MPa

Ans. C

Sol. Given,

tensile load acting axially (Pt)= 10 kN

cross-sectional area (A) =20 x 20

= 400 mm^2

tensile stress developed =

$$\sigma_t = \frac{10^4}{400} = 25 MPa$$

170. A machine component is subjected to variable loading such that amplitude stress, mean stress. endurance Limit stress, ultimate strength and yield strength are 90MPa, 150MPa, 270 MPa, 600MPa, 450 MPa respectively. Find the factor of safety Using Soderberg line.

A. 1.7
B. 1.5
C. 3.75
D. 4

Ans. B

Sol. Given,

σ_a = 90 MPa, σ_m = 150 MPa, σ_e = 270 MPa, σ_{ut} = 600 MPa, σ_{yt} = 450 MPa

Acc. to Soderberg equations,

$$\frac{\sigma_a}{\sigma_e} + \frac{\sigma_m}{\sigma_{yt}} = \frac{1}{N}$$

$$\frac{90}{270} + \frac{150}{450} = \frac{1}{N}$$

N = 1.5

171. Which one of the following expresses the maximum blade efficiency of a Parson's turbine?

A. $\frac{2\cos^2\alpha}{1+\cos^2\alpha}$
B. $\frac{\cos^2\alpha}{1+2\cos^2\alpha}$
C. $\frac{\cos\alpha}{1+\cos^2\alpha}$
D. $\frac{\cos\alpha}{2}$

Ans. A

Sol. Maximum efficiency of Parson's reaction turbine

$$\eta_{max} = \frac{2\cos^2\alpha}{1+\cos^2\alpha},$$

Where ∝ is the jet angle at the entrance.

172. When a rectangular section beam is loaded transversely along the length shear stress is maximum at

A. Top fibre of rectangular beam

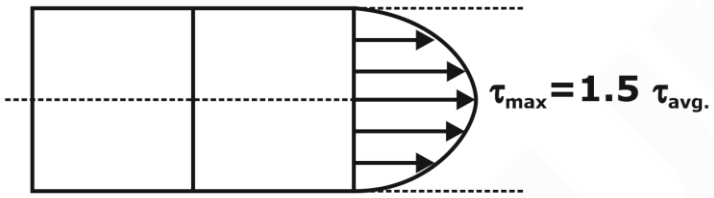
B. Middle fibre of rectangular beam

C. Bottom fibre of rectangular beam

D. None of these

Ans. B

Sol. * In the case of the rectangular section, the maximum shear stress at the neutral axis is 50% more than the mean value.



* When a rectangular section beam is loaded transversely along the length shear stress is maximum at Middle fiber of rectangular beam

173. Morse test is generally conducted on

A. Vertical cylinder

B. Horizontal cylinder

C. Single cylinder engine

D. Multicylinder engine

Ans. D

Sol. The purpose of Morse test is to obtain the approximate indicated power of a Multi cylinder engine. The Morse Test is performed to find the power developed in each cylinder in a multi cylinder internal combustion engine. It basically gives the relationship between indicated power and brake power.

174. The efficiency of an ideal heat engine increases by

A. Decreasing source temperature

B. Increasing sink temperature

C. Decreasing sink Temperature

D. Efficiency does not change with change in Temperature

Ans. C

Sol. $\eta = 1 - \frac{T_L}{T_H} = \frac{T_H - T_L}{T_H}$

$\eta \propto (T_H - T_L) \Rightarrow$ More the difference, more will be the efficiency but decreasing T_L will be more beneficial.

175. The welding process in which bare wire is used as electrode, granular flux is used and the process is characterized by its high speed welding, is known as

A. Shielded are welding
B. Plasma arc welding
C. Submerged arc welding
D. Gas metal arc welding

Ans. C

Sol. Submerged arc welding process is a process in which bare electrode usually copper coated to increase the conductivity, granular flux is used.

Advantages of submerged arc welding are:

A. A constant arc length can be maintained which improves the bead quality.

B. Long weld run can be performed in one setup

176. For an isothermal process, the two integrals $\int pdv$ and $-\int vdp$ gives the

A. Same value
B. Different value
C. Either same or different
D. None of these

Ans. A

Sol. For isothermal process

pV = constant

pdV + Vdp = 0

pdV = − Vdp

taking integral both side, we get

$\int pdV = -\int Vdp$

So the correct option is (a).

177. In a tool wear study experiment, it is found that doubling cutting speed reduces the tool life to 1/8th of the original. The Taylor's tool life index is

A. ½
B. 1/3
C. ¼
D. 1/8

Ans. B

Sol. From the taylor's tool life equation $VT^n = C = 2V \times \left(\frac{T}{8}\right)^n$

$vidingn$th is increased hence the speed of travel of the extruded product is greater than that of the ram.

$$\frac{VT^n}{2V\left(\frac{T}{8}\right)^n} = 1$$

$$T^n = 2\left(\frac{T}{8}\right)^n$$

$$\frac{1}{2} = \left(\frac{1}{2}\right)^{3n}$$

Comparing powers from both sides:

1 = 3n

n = 1/3

Hence the correct answer is (B)

178. Match the following:

List-I

A. Boiler

B. turbine

C. Condenser

D. pump

List-II

1) reversible adiabatic expansion of steam

2) constant pressure heat addition

3) reversible adiabatic compression

4) constant pressure heat rejection

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

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

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

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

Ans. A

Sol. A. Boiler= 2) constant pressure heat addition

B. turbine =1) reversible adiabatic expansion of steam

C. Condenser = 4) constant pressure heat rejection

D. pump = 3) reversible adiabatic compression

179. Isentropic flow is

A. Irreversible adiabatic flow

B. Reversible adiabatic flow

C. Ideal fluid flow

D. Frictionless reversible flow

Ans. B

Sol. The second law of thermodynamics states that,

$$dS \geq \frac{\delta Q}{T}$$

Where δQ is the amount of energy the system gains by heating, T is the temperature of the system, and dS is the change in entropy. The equality sign will hold for a reversible process. For a reversible isentropic process, there is no transfer of heat energy and therefore the process is also adiabatic. For an irreversible process, the entropy will increases. Here a removal of heat from the system (cooling) is necessary to maintain a constant internal entropy for an irreversible process in order to make if isetropic. Thus an irreversible isentropic precess is not adiabatic.

180. Misrun refers to _____.

A. casting defect
B. process of fabrication
C. process of heat treatment
D. weathering of non-ferrous materials

Ans. A

Sol. * Misrun refers when the metal is unable to fill the mold cavity completely and thus leaves unfilled cavities.

* It is a casting defect.

181. Choose the correct statements:

a. Thermal diffusivity is directly proportional to thermal conductivity.

b. Thermal diffusivity is inversely proportional to density of substance.

c. Thermal diffusivity is inversely proportional to specific heat.

A. Only a
B. Both a & b
C. Both a & c
D. All a, b & c

Ans. D

Sol. From the heat energy balance equation, we see that

$$\alpha = \frac{k}{\rho C_p}$$

o Thermal diffusivity is directly proportional to thermal conductivity.

o Thermal diffusivity is inversely proportional to density of substance.

o Thermal diffusivity is inversely proportional to specific heat.

182. Freon leakage is detected by

A. Sulphur stick
B. Halide torch
C. Ammonia swab test
D. None of the above

Ans. B

Sol. * Freon leakages are detected by "halide torch test"

* Ammonia leakages are detected by "sulphur stick test"

* Sulphides leakages are detected by "Ammonia swab test".

183. In a Brayton cycle, the value of optimum pressure ratio for maximum net work done between temperatures T_1 and T_3, where T_3 is the maximum temperature and T_1 is the minimum temperature is

A. $r_p = \left(\frac{T_3}{T_1}\right)^{\frac{\gamma}{\gamma-1}}$
B. $r_p = \left(\frac{T_3}{T_1}\right)^{\frac{\gamma-1}{2\gamma}}$
C. $(r_p)_{opt} = \left(\frac{T_3}{T_1}\right)^{\frac{\gamma}{2(\gamma-1)}}$
D. $r_p = \left(\frac{T_3}{T_1}\right)^{\frac{2(\gamma-1)}{\gamma}}$

Ans. C

Sol. Optimum pressure ratio for maximum workout put

$$(r_p)_{opt} = \left(\frac{T_3}{T_1}\right)^{\frac{\gamma}{2(\gamma-1)}}$$

Option 3 is the correct answer.

184. Equation of a stream line in a 2D flow is

A. (dy/u)=(dx/v)
B. (u/dx)=(dy/v)
C. u =(dx/t), (dy/t)=v
D. (dx/u)=(dy/v)

Ans. D

Sol. A streamline is defined as a line which is everywhere parallel or tangent to the local velocity vector V(x, y, z, t) = ui + vj + wk.

Define ds = dx i + dy j + dz k as an infinitesimal arc-length vector along the streamline. Since this is parallel to V, we must have

ds × V = 0

(w dy − v dz)i + (u dz − w dx) j + (v dx − u dy) k = 0

In 2-D, we have dz = 0 and w = 0, and only the k component of the equation above is non-trivial. It can be written as an Ordinary Differential Equation for the streamline shape y(x).

dy/dx =v/u

185. Find the value of allowance and shaft tolerance according to hole base system if Hole : $47_{+0.50}{}^{+0.52}$ mm , Shaft :$47_{+0.45}{}^{+0.47}$ mm

A. 0.02mm, 0.03mm
B. 0.03mm, 0.02mm
C. 0.03mm, 0.03mm
D. 0.02mm, 0.02mm

Ans. B

Sol. Allowance = maximum metal condition of hole – maximum metal condition of shaft

= low limit of hole – high limit of shaft

= 47.50 – 47.47

= 0.03 mm

Shaft tolerance = high limit – low limit

= 47.47-47.45

= 0.02mm

186. If section modulus of a beam is increased, the bending stress in the beam will:

A. Not change
B. Increase
C. Decrease
D. Become zero

Ans. C

Sol. * Because bending stress= My/I, where I/y=Z= section modulus.

* Bending stress= M/Z,

Therefore, as section modulus increases, the bending stress decreases.

187. Bulldozer blades are made from

A. Babbit alloy
B. Low carbon steel
C. Hadfield manganese steel
D. Monel alloy

Ans. C

Sol. Bulldozer blades are made from Hadfield manganese steel.

188. In the fuel mixture of iso octane and n-heptane, the % of n-heptane by volume is 40. The octane no. of fuel is

A. 40
B. 60
C. 24
D. 100

Ans. B

Sol. The octane no. of a fuel is the % of iso octane by volume in a mixture of iso octane and n-heptane which produces the same knock intensity as the given fuel.

% of iso octane = 100-40 =60%

Octane no. = 60

189. The hardness of a grinding wheel is determined by the

A. hardness of abrasive grains
B. ability of the bond to retain abrasives
C. hardness of the bond
D. ability of the grinding wheel to penetrate the work piece

Ans. B

Sol. The strength of a bond is designated in the grade of the grinding wheel. The bond is said to have a hard grade if distances between each abrasive grain are very strong and retain the grains well against the grinding forces tending to pry them loose. A wheel is said to have a soft grade if only a small force is needed to release the grains. It is the relative amount of bond in the wheel that determines its grade or hardness.

190. What does hydrostatic pressure in extrusion process improve

A. Ductility
B. Compressive strength
C. Brittleness
D. Tensile

Ans. A

Sol. Hydrostatic pressure increases the ductility of the material therefore, britte material can be extruded by this method.

191. Which of the following statement is correct?

A. $C_{d\ (venturi\ meter)} \sim C_{d\ (orifice\ meter)} > C_{d\ (pitot\ tube)}$
B. $C_{d\ (venturi\ meter)} \sim C_{d\ (pitot\ tube)} < C_{d\ (orifice\ meter)}$
C. $C_{d\ (pitot\ tube)} \sim C_{d\ (orifice\ meter)} > C_{d\ (venturi\ meter)}$
D. $C_{d\ (pitot\ tube)} \sim C_{d\ (venturi\ meter)} > C_{d\ (orifice\ meter)}$

Ans. D

Sol. * $C_{d\ (pitot\ tube)}$ and $C_{d\ (venturi\ meter)}$ are approximately equal to 0.98.

* $C_{d\ (orifice\ meter)}$ is approximately around 0.68

So from this data,

$C_{d\ (pitot\ tube)} \sim C_{d\ (venturi\ meter)} > C_{d\ (orifice\ meter)}$

statement 4 is correct

192. The lead angle of a worm is 20 °. Its helix angle will be _____ degree.

A. 60^0 B. 70^0

C. 80^0 D. 90^0

Ans. B

Sol. Given,

lead angle of a worm is 20°

Helix angle, α = 90° – lead angle = 90° – 20° = 70°

193. A heat engine performs a work of 100 kJ per cycle. The efficiency of the engine of the engine is 50%. What will be the amount of heat rejected (in kJ) per cycle?

A. 0 B. 50

C. 100 D. 200

Ans. C

Sol. $\eta = \frac{\text{W. D.}}{\text{Heat Supplied}}$

$\eta = \frac{W}{Q_s}$

$0.5 = \frac{100}{Q_s}$

Q_s = 200 kJ

$W = Q_s - Q_R$

$100 = 200 - Q_R$

Q_R = 100 kJ

194. The property of the material to regain its original shape after deformation when the external forces are removed is _____.

A. plasticity B. elasticity

C. durability D. None of these

Ans. B

Sol. Elasticity is the ability of an object or material to resume its normal shape after being stretched or compressed.

195. The speed ratio for which the Parson's turbine has maximum efficiency is

A. cos (α) B. sin (α)

C. 1 + cosα D. 1 + sinα

Ans. A

Sol. At maximum efficiency the optimum speed ratio = $\frac{u}{V} = \cos(\alpha)$

196. The critical temperature for water is

A. 374.2 °C
B. 221.2 °C
C. 100 °C
D. 0 °C

Ans. A

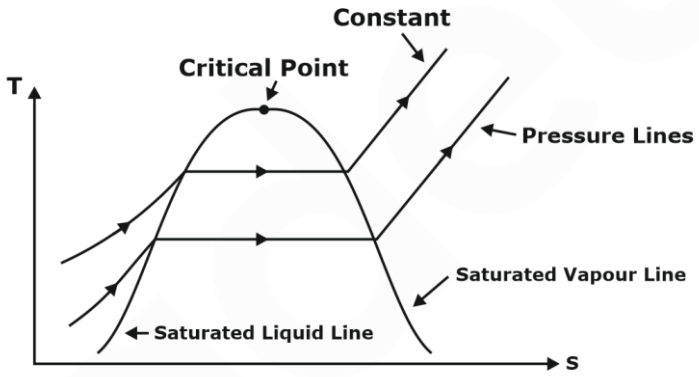
Sol. The point, where saturated liquid and saturated vapour line meets in the T-S diagram of water is called critical point and the temperature, pressure and specific volume corresponding to this point is called critical temperature(T_c), critical pressure(P_c) and critical specific volume (v_c).

For water,

T_c = 374.2°C

P_c = 221.2 bar

v_c = 0.00317 m^3/kg



197. The self-ignition temperature of diesel is _____ as compared to that of petrol.

A. is higher
B. is lower
C. is same
D. cannot be determined

Ans. B

Sol. * Self Ignition Temperature (SIT) is the lowest temperature at which a diesel/Petrol will ignite itself without the presence of a spark or flame.

*SIT of diesel is 210^0C

* SIT of petrol is (240^0C - 280^0C)

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

List-I

A) Pelton turbine

B) Francis turbine

C) Propeller turbine

D) Kaplan turbine

List-II

1) Specific speed from 300 to 1000 + axial flow with fixed runner vanes.

2) Specific speed from 10 to 50 + tangential flow.

3) Specific speed from 60 to 300 +mixed flow.

4) Specific speed from 300 to 1000 +axial flow with adjustable runner vanes.

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

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

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

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

Ans. C

Sol. A) Pelton turbine = 2) Specific speed from 10 to 50 + tangential flow.

B) Francis turbine = 3) Specific speed from 60 to 300 +mixed flow.

C) Propeller turbine = 1) Specific speed from 300 to 1000 + axial flow with fixed runner vanes.

D) Kaplan turbine = 4) Specific speed from 300 to 1000 +axial flow with adjustable runner vanes.

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

List-I

A) Number of Transfer Units

B) Periodic flow heat exchangers

C) Phase change

D) Deposition on heat exchanger surface

List-II

1) Regenerators

2) Fouling factor

3) A measure of heat exchanger size

4) Condensers

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

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

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

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

Ans. C

Sol. A) Number of Transfer Units = 3) A measure of heat exchanger size

Number of transfer units is used as a measure of heat exchanger size NTU is a measure of effectiveness of heat exchanger.

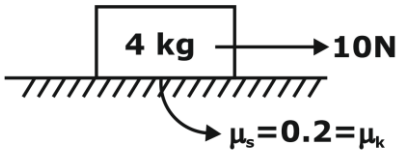
$$NTU = \frac{UA}{C_{min}}$$

B) Periodic flow heat exchangers = 1) Regenerators

C) Phase change = 4) Condensers

D) Deposition on heat exchanger surface = 2) Fouling factor

200. Find friction force and acceleration of block shown in figure (g = 10 m/s^2)



A. 8 N and 0.5 m/s^2

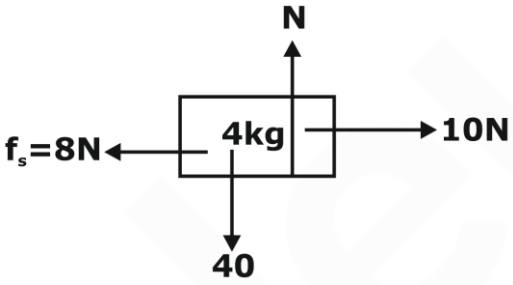
B. 8 N and 0 m/s^2

C. 10 N and 0.5 m/s^2

D. 10 N and 0 m/s^2

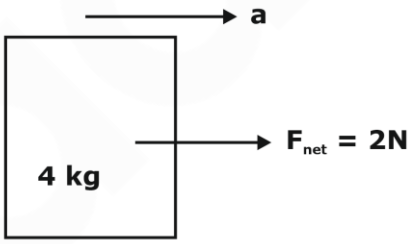
Ans. A

Sol. $f_s = \mu_s \times N = 0.2 \times 40 = 8N \Leftarrow$ friction force



Body moves only if

$F_{applied} > F_{limiting}$



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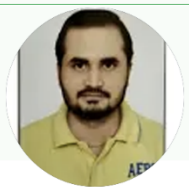

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