MEGA MOCK CHALLENGE

gradeup

SSC JE 2019-20

Mechanical Engineering

Mega Mock Challenge

(04 Mar - 05 Mar 2020)

Questions & Solutions

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

   1161, 1164, 1168, 1173, 1179, ?

   A. 1186   B. 1196

   C. 1185   D. 1197

Ans. A

Sol. 1161 + 3 = 1164

   1164 + 4 = 1168

   1168 + 5 = 1173

   1173 + 6 = 1179

   1179 + 7 = 1186

   Hence, option A is the correct answer.

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

   Punjab : Bhangra : : Gujarat : ?

   A. Bihu   B. Garba

   C. Ghumar   D. Kathak

Ans. B

Sol. Bhangra is the traditional dance of Punjab. Similarly, Garba is the traditional dance of Gujarat. Thus Gujarat is related to Garba.

   Hence, option B is the correct answer.

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

   1) Philosopher   2) Pharmacy

   3) Piercing   4) Salesman

   5) Saleswoman

   A. 21345   B. 53214

   C. 34215   D. 24513

Ans. A

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

   2) Pharmacy

   1) Philosopher

   3) Piercing

   4) Salesman

   5) Saleswoman

   Hence, option A is the correct answer.

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

42 : 14 : : 56 : ?

A. 18 B. 41

C. 48 D. 65

Ans. B

Sol. As in the 1st pair:

$4 \times 2 + (4 + 2) \Rightarrow 8 + 6 = 14$

Therefore, 2nd pair will be like:

$5 \times 6 + (5 + 6) \Rightarrow 30 + 11 = 41$

Hence, option B is the correct response.

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

A. JQ B. HS

C. BX D. GT

Ans. C

Sol.

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

J + Q = 27

H + S = 27

B + X = 26

G + T = 27

Hence, option C is the correct answer.

6. A series is given with one term missing. Select the correct alternative from the given ones that will complete the series.
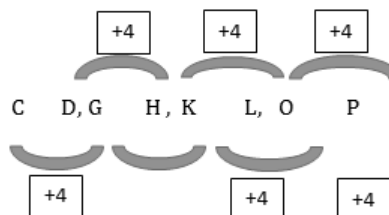
CD, GH, KL,?
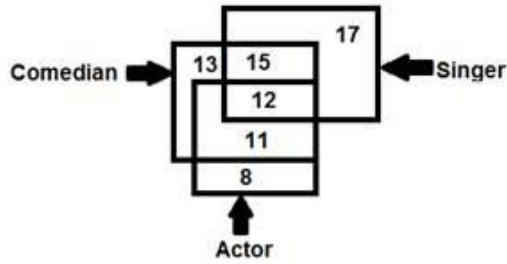
A. PN B. NO

C. NP D. OP

Ans. D

Sol. There are 26 alphabets in English and if we give assign 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

C D,G H,K L,O P (+4 each)

Hence, option D is the correct answer.

7. The following Venn Diagram shows information about the total number of the person who has a different profession.
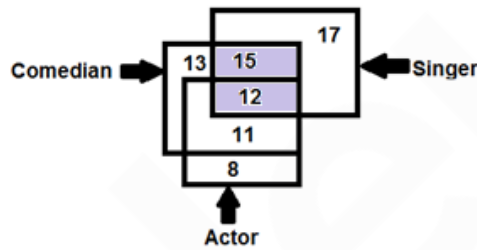

What is the ratio of Singer and Comedian but not Actor to all actor, singer and comedian?

A. 4/5

B. 13/8

C. 15/11

D. 5/4

Ans. D

Sol.

The ratio of the Singer and Comedian but not Actor to all actor, singer and comedian = 15/12

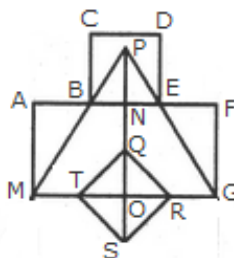On solving we get = 5/4

Hence, option D is the correct answer.

8. How many triangles are in the given figure?

A. 14

B. 25

C. 16

D. 23

Ans. C

Sol.

16 triangles in all; BPN, PNE, ABM, EFG, QRO, RSO, STO , QTO , BPE, TQR, QRS, RST , STQ,MPO, GPO and MPG.

Hence, option C is the correct answer.

9.   In the following question, select the related word from the given alternatives.
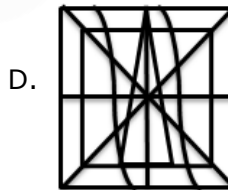
DOG : KENNEL :: BEE : ?

A. HIVE   B. NEST

C. HOLE   D. BARN

Ans. A

Sol. Dog lives in a kennel. Similarly, bee lives in a hive.

Hence, option A is the correct answer.

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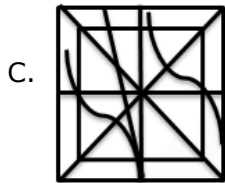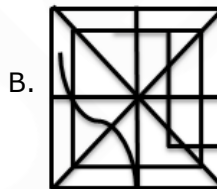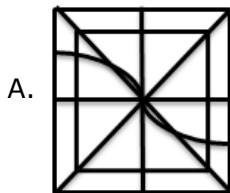
Ans. D

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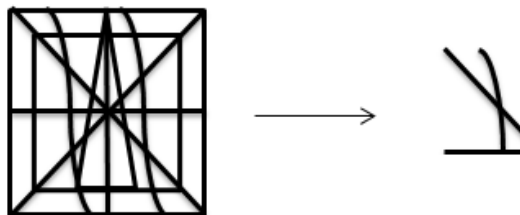
Hence, Option D is the correct answer.

11. A piece of paper is folded and punched as shown below. From the given responses indicate how it will appear when opened.
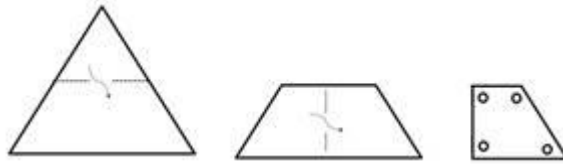
A.
B.
C.
D.

Ans. C

Sol. After Unfolded the paper we get:
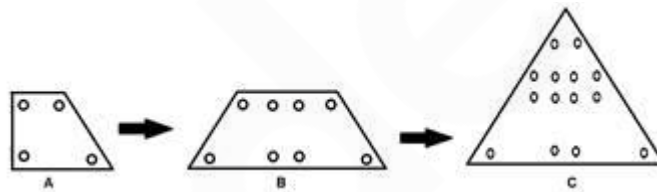
Hence, option C is the correct answer.

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

AC, EG, ?, MO

A. IK
B. IJ

C. IL
D. IM

Ans. A

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

And, the series is written with only odd position alphabets i.e.

AC, EG, IK, MO

Hence, option A is the correct answer.

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

    SELECTIVENESS

    A. SUSTAIN   B. VEST

    C. CANCEL   D. SELLES

Ans. B

Sol. Clearly, the word 'VEST' can be formed by using the letters of given word.

    Hence, option B is the correct answer.

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

150	225	75
400	120	?
80	140	44

    A. 104   B. 130

    C. 120   D. 224

Ans. A

Sol. Logic-

    Row 1:

    (150+225)/5=75

    Row 2:

    (400+120)/5=104

    Row 3:

    (80+140)/5=44

    Hence, option A is the correct answer.

15. A statement is given followed by two course of action. Candidate is required to grasp the statement and analyses the problem or policy it mentions and then decide which course of action logically follows.

    Statement:

    Google parent company Alphabet has moved its Jigsaw technology incubator under Google management.

    Course of action:

    I. Jigsaw was focused on online security issues like harassment and misinformation.

    II. Google management should have the best policy to control Jigsaw technology incubator.

    A. Only I follows   B. Only II follows

    C. Both I and II follow   D. Either I or II follows

Ans. B

Sol. Course of action: I. Jigsaw was focused on online security issues like harassment and misinformation. (It does not follow as its just a statement, not action.)

II. Google management should have the best policy to control Jigsaw technology incubator. (It follows.)

So, Only II follows.

Hence, option B is the correct answer.

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

A. 2437   B. 9118

C. 8548   D. 7649

Ans. A

Sol. If we consider the last two digits as one number, then that number is given by:

$9118 \rightarrow 18 = 9 \times (1 + 1) \rightarrow$ i.e. first number multiplied by succession of 2nd number.

$8548 \rightarrow 48 = 8 \times (5 + 1)$

$7649 \rightarrow 49 = 7 \times (6 + 1)$

But it's not applicable with 2437.

Hence, option A is the correct answer.

17. 12 * 18 * 3 * 4 = 2 * 5 * 4

Which set of symbols can replace *?

A. +, x, / ,x, +   B. +, /, - ,x, -

C. +, /, - , x, +   D. +, x, - , /, x

Ans. C

Sol. option A 12+18x3/4 = 25.5 and RHS 2x5+4 = 14 so LHS not equal to RHS.

option B 12+18/3-4 = 14 and RHS 2x5-4 = 6, LHS not equal to RHS.

option C 12+18/3-4 gives 14 and RHS 2x5+4 gives 14 so RHS=LHS

Hence, option C is the correct answer.

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

A. Oscar Award   B. Arjuna Award

C. Dhyan Chand Award   D. Dronacharya Award

Ans. A

Sol. In this question, we show that –

Option A (Oscar Award) is the award in the field of the film industry and rest Option B (Arjuna Award), option C (Dhyan Chand Award), and Option D (Dronacharya Award) are the awards in the field of sports.

So, Oscar Award is different from others.

Hence, option A is the correct answer.

19. If 9 x 0 x 4 x 1 = 5 and 1 x 7 x 3 x 2 = 12 then what will be the value of 0 x 2 x 3 x 4 = ?

   A. 11   B. 10

   C. 7   D. None of these.

Ans. C

Sol. Here, the logic used in the given equations is as follows:

   (First Number x Second Number) + Third Number + Fourth Number = Result.

   Equation I: 9 x 0 x 4 x 1 = 5 $\Rightarrow$ (9 x 0) + 4 + 1 = 5

   Equation II: 1 x 7 x 3 x 2 = 5 $\Rightarrow$ (1 x 7) + 3 + 2 = 12

   Similarly for equation III we get,

   $\Rightarrow$ (0 x 2) + 3 + 4 = 7

   Hence, option C is the correct answer.

20. A series is given with one term missing. Select the correct alternative from the given ones

   that will complete the series.

   6, 13, 33.5, 101.5, 356.25, ?

   A. 1526   B. 1426

   C. 1326   D. 1725

Ans. B

Sol. Given series follows the pattern given below:

   6×2+1=13

   13×2.5+1=33.5

   33.5×3+1=101.5

   101.5×3.5+1=356.25

   356.25×4+1=1426

   Hence, option B is the correct answer.

21. Ramesh goes 8m in the west direction and turns to his left and goes 10m, again he took a

   left turn and moves 18m. Now he turned right and moved 10m and finally he turns 45

   degree clockwise and goes 5m. Now he is in which direction from his starting point?

   A. north-east   B. south-east

   C. north-west   D. south-west

Ans. B

Sol.

8m

starting point

10m

18m

10m

5m

end point
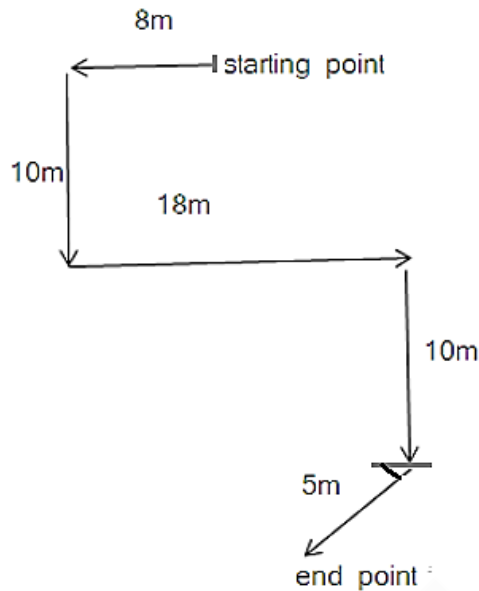
So, he is in south-east direction from his starting point.

Hence, option B is the correct answer.

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

1) Jumbo 2) Juggling

3) Justice 4) Jewel

5) Jealous

A. 54213 B. 23415

C. 12345 D. 42315

Ans. A

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

5) Jealous

4) Jewel

2) Juggling

1) Jumbo Jet

3) Justice

Hence, option A is the correct answer.

23. Lata is in the north of Jaya at a distance of 50m who is in the west of Abhay at a distance of 80m. Abhay is in the east of Lalit at a distance of 40m who is in the north of Deepa at a distance of 30m. Deepa is in the south of Prakash at a distance of 20m who is in the east of Gopi at a distance of 100m. Abhay is in which direction with respect to Lata?

A. south-east B. north-east

C. east D. west

Ans. A

Sol. According to question:-
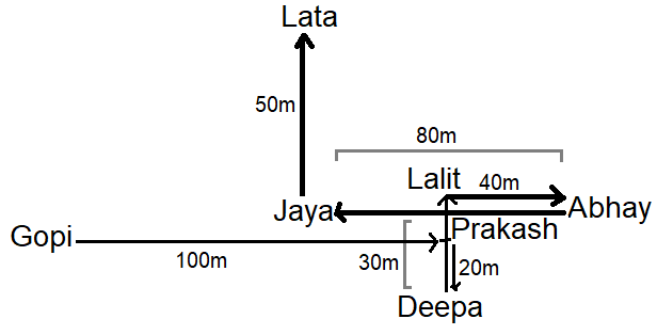
So, Abhay is in south-east direction with respect to Lata.

Hence, option A is the correct answer.

24. A is five ranks ahead of B who ranks 20th in a class of forty students. What is A's rank from the last?

A. 23   B. 22

C. 26   D. 27

Ans. C

Sol. B = 20th from top

A is five rank ahead = 20-5 = 15th from top

So A rank from bottom = total number of students – A rank from top + 1

= 40 – 15 + 1

= 25 + 1

= 26

A's rank from last/bottom is 26.

Hence, option C is the correct answer.

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

Statements :

Some drive are cassettes.

All cassettes are memory.

Conclusions :

I. All memory are cassettes.

II. All drive are cassettes.

III. Some memory are drive.

A. Only conclusion III follows   B. Only conclusion I and II follow

C. None of the conclusions follows.   D. Ether conclusion II or III follows.

Ans. A

Sol. Minimum Possible diagram is-
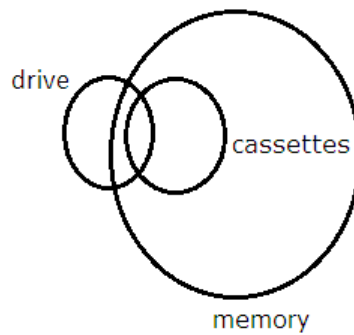
Conclusions :

I. All memory are cassettes. (It does not follow as its just a possibility, not surety.)

II. All drive are cassettes.(It also does not follow independently as its just a possibility, not surety.)

III. Some memory are drive. (It follows as its obvious from the above diagram.)

So, Only conclusion III follows.

Hence, option A is the correct answer.

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

Statements :

No Lines are Tables.

All Tables are Radar.

Conclusions :

I. Some lines are radar.

II. All radar are tables.

III. No lines are radar.

A. Ether conclusion I or III follows.

B. Only conclusion I and II follow

C. Only conclusion I and III follow

D. All the conclusions I, II and III follow

Ans. A

Sol. Minimum Possible diagram is-
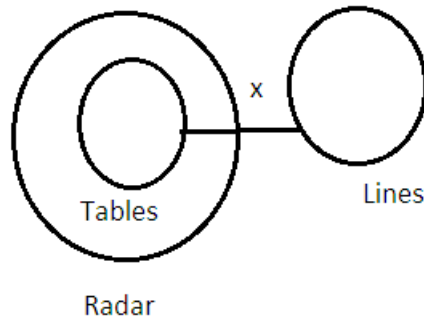
Radar

Conclusions :

I. Some lines are radar. (It does not follow independently as it is just a possibility, not surety.)

II. All radar are tables. (It also does not follow independently as it is just a possibility, not surety.)

III. No lines are radar. (It also does not follow independently as it is just a possibility, not surety.)

Here, Either conclusion I or III follows because some + no makes either or situation.

Hence, option A is the correct answer.

27. Select the figure that will come next in the following figure series.

A.   B.

C.   D.
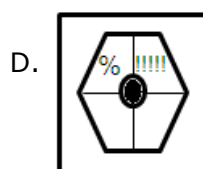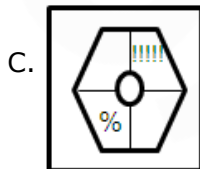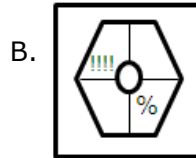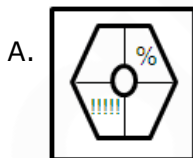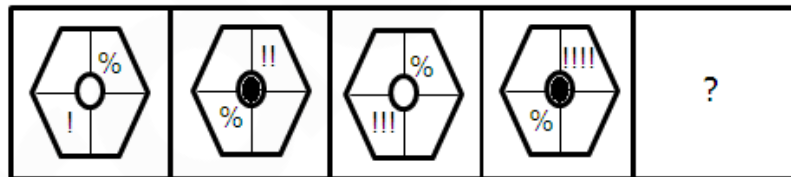
Ans. A

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

Logic- Circle gets whitened and darken alternately. % and ! interchange its places in each step. ! is increasing by +1 in each step.

Hence, option A is the correct answer.

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

A. Hudhud   B. Trami

C. Beetle   D. Vardah

Ans. C

Sol. Except for Beetle, all are the name of Cyclone. The beetle is an insect.

Hence, option C is different from others.

29. Which of the following diagrams indicates the best relation between Fox, carnivorous and toads?

A.   B.

C.   D.

Ans. C

Sol. Toad and Fox are carnivorous animals.

Hence, option C is the correct answer.

30. Which symbol will be on the face opposite to the face with symbol *?
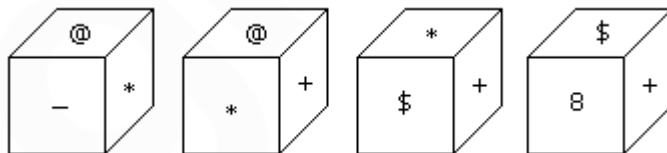
A. @   B. $

C. 8   D. +

Ans. C

Sol. The symbol of the adjacent faces to face with symbol * are @, -, + and $. Hence the required symbol is 8.

Hence, option C is the correct answer.

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

    EHJ : KNP :: SVX : ?

    A. XZZ   B. YBD

    C. BDF   D. ZBD

Ans. B

Sol.

E	H	J
+6	+6	+6
↓	↓	↓
K	N	P

Similarly,

S	V	X
+6	+6	+6
↓	↓	↓
Y	B	D

Thus, SVX is related to YBD.

Hence, option B is the correct answer.

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

    A. CEF   B. GIJ

    C. LNO   D. STW

Ans. D

Sol.

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

C + 2 = E, E + 1 = F

G + 2 = I, I + 1 =J

L + 2 = N, N + 1 = O

S + 1 = T, T + 3 = W

Hence, option D 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.

    50 : 99

    A. 63 : 77   B. 41 : 66

    C. 65 : 88   D. 59 : 99

Ans. C

Sol. As,

50 : 99 = 10 × 5, 9 × 11

Similarly,

65 : 88 = 13 × 5, 8 × 11

Hence, option C is the correct response.

34. Select the correct mirror image of the given figure when the mirror is placed to the right of the figure.

A.   B.

C.   D.
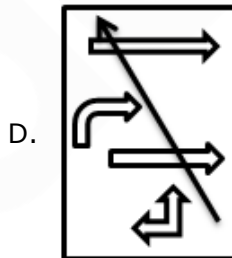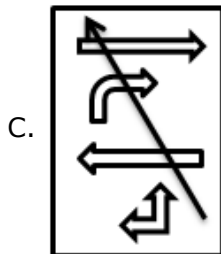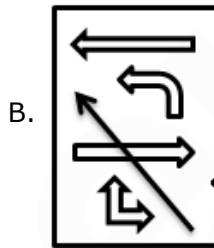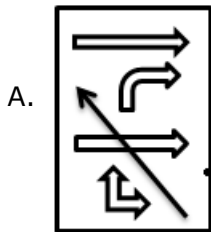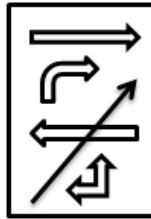
Ans. B

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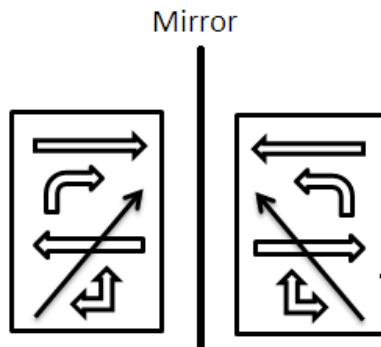
Hence, option B is the correct answer.

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

   A. DAH
   B. IFM
   C. ROV
   D. FHA

Ans. D

Sol.

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

D – 3 = A, D + 4 = H

I – 3 = F, I + 4 = M

R – 3 = O, R + 4 =V

F + 2 = H, F – 5 = A

Hence, option D is the correct answer.

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

   A. 14 – 48
   B. 12 – 72
   C. 11 – 88
   D. 8 – 24

Ans. A

Sol. Here 48 is not a multiple of 14 In rest, all pairs 2nd number is multiple of the first number.

   12 x 6 = 72

   11 x 8 = 88

   8 x 3 = 24

   Thus 14 – 48 is the odd number pair.

   Hence, option A is the correct answer.

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

   A. 11 – 15
   B. 13 – 17
   C. 12 – 16
   D. 14 – 16

Ans. D

Sol. From the given options,

   11 + 4 = 15

   13 + 4 = 17

   12 + 4 = 16

   14 + 4 ≠ 16

   Clearly, option D is not following the rule like others.

   Hence, the correct option is D.

38. In a certain code language, BOOKS is written as ROOKA and DRONS is written as RRONC. How would MANAGE be written in that code language?

A. MMAZGE   B. GEMMAZ

C. MMGEAZ   D. AZMMGE

Ans. C

Sol. All the letters are written alphabetically from right to the left and then the first and the last letters are moved one place backward in the English alphabet.

So, MANAGE = MMGEAZ

Hence, option C is the correct answer.

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

LKJ : MNO :: EDC : ?

A. FGI   B. FHG

C. FGH   D. FGJ

Ans. C

Sol. Let us first write down the alphabets and their corresponding positions in the English alphabetic series.

A	B	C	D	E	F	G	H	I	J
1	2	3	4	5	6	7	8	9	10
K	L	M	N	O	P	Q	R	S	T
11	12	13	14	15	16	17	18	19	20

U	V	W	X	Y	Z
21	22	23	24	25	26

Here, LKJ : MNO may be written as follows:
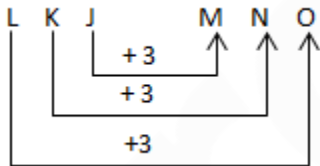
Similarly,
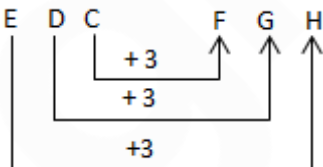
Hence, option C is the correct answer.

40. Four words are given below out of which three are alike in some manner and one is different. Which is different from the rest?

A. Fox   B. Wolf

C. Jackal   D. Deer

Ans. D

Sol. Except deer, all other animal eats meat, while deer eat grass.

Hence, option D is different from the rest.

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

Question figure:

Answer figure:

| A | B | C | D |

A. Figure A   B. Figure B

C. Figure C   D. Figure D

Ans. C

Sol. After observing the given diagram carefully, option figure C will complete the given question figure.

Hence, option C is the correct answer.

42. In a certain code language, "CLAT-UG" is written as "8". How is "NEET-PG" written in that code language?

A. 21   B. 27

C. 19   D. 17

Ans. A

Sol.

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

Considering the place value of letters we get,

CLAT-UG ⇒ (3 + 12 + 1 + 20 =36) – (21 + 7 = 28) → 36 – 28 = 8

Similarly,

NEET-PG ⇒ (14 + 5 + 5 + 20 = 44) − (16 + 7 = 23) →44 − 23 = 21

Thus code for NEET-PG = 21

Hence, option B is the correct answer.

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

12 : 18 :: 80 : ?

A. 125   B. 100

C. 120   D. 122

Ans. C

Sol. 6 × 2 = 12 and 6 × 3 = 18

Similarly,

40 × 2 = 80 and 40 × 3 = 120

Hence, option C is the correct answer.

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

ART, DTU, ?, JXW, MZX, PBY

A. MMT   B. KUU

C. FBB   D. GVV

Ans. D

Sol. Given series follows the pattern given below:

$$A \xrightarrow{+3} D \xrightarrow{+3} G \xrightarrow{+3} J \xrightarrow{+3} M \xrightarrow{+3} P$$

$$R \xrightarrow{+2} T \xrightarrow{+2} V \xrightarrow{+2} X \xrightarrow{+2} Z \xrightarrow{+2} B$$

$$T \xrightarrow{+1} U \xrightarrow{+1} V \xrightarrow{+1} W \xrightarrow{+1} X \xrightarrow{+1} Y$$
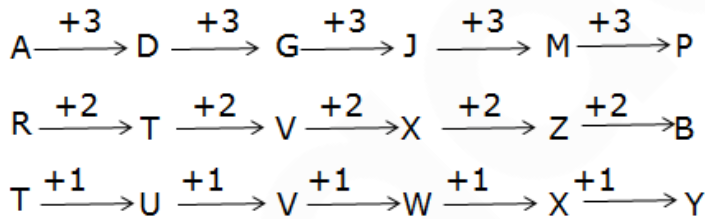
Hence, option D is the correct answer.

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

i. Treadmill   ii. Treason

iii. Treacherous   iv. Tread

A. ii, iii, iv, i   B. iii, iv, ii, i

C. iii, iv, i, ii   D. i, ii, iii, iv

Ans. C

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

iii. Treacherous

iv. Tread

i. Treadmill

ii. Treason

Hence, option C is the correct response.

46. Nikhil is the father-in-law of Tara. Tara is the wife of Rahul. How is Rahul's brother related to Nikhil?

   A. Brother
   B. Father
   C. Son
   D. Father-in-law

Ans. C

Sol.
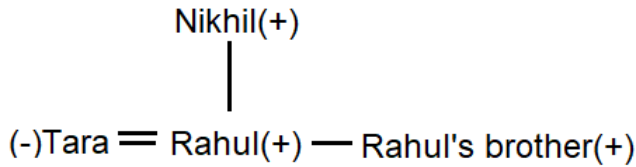
Rahul's brother will be the son of his father, who is Nikhil.

Hence, option C is the correct answer.

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

   WD : TF :: TG : ?

   A. QR
   B. IQ
   C. QI
   D. IP

Ans. C

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

   And, if we observe the difference between the respective alphabet in the series given above:

   W – 3 = T

   D + 2 = F

   Likewise,

   T – 3 = Q

   G + 2 = I

   Hence, option C is the correct answer.

48. Read the following information and answer the questions given below it:

   'A + B' means 'A is the son of B'.

   'A – B' means 'A is the wife of B'.

   'A × B' means 'A is the sister of B'.

   'A ÷ B' means 'A is the brother of B'.

   'A = B' means 'A is the father of B'.

   In the expression G + H – I ÷ J = K, how is H related to K.

   A. Aunt
   B. Mother
   C. Nephew
   D. Can't be determined

Ans. A

Sol.
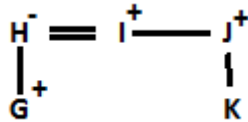
K is the child of J who is I's brother which means I is the uncle of K.

Since H is the wife of I. therefore, H is the aunt of K.

Hence, option A is the correct answer.

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

Hardware : Mouse :: Software : ?

A. Stylus   B. Unix

C. Mother Board   D. CPU

Ans. B

Sol. A Mouse is hardware in the computer system. Similarly, Unix is the software in the computer system and others are hardware.

Hence, option B is the correct answer.

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

17, 32, 60, 114, 220, ?

A. 598   B. 490

C. 430   D. 394

Ans. C

Sol. Given series follows the pattern given below:

17*2-2=32

32*2-4=60

60*2-6=114

114*2-8=220

220*2-10=430

Hence, option C is the correct answer.

51. What is value of 1 light year?

A. 1.46×10^{15} m   B. 9.46×10^{15} m

C. 5.50×10^{15} m   D. $9{:}50 \times 10^{15}$ m

Ans. B

Sol. • A light-year is a unit of distance.

• The value of 1 light year is 9.46×10^{15} m.

• A light-year is the distance that light travels in vacuum in one Julian year.

52. What is the tenure of Judge in the International Court of Justice?

A. 5   B. 6

C. 8   D. 9

Ans. D

Sol. ● The tenure of Judge in the International Court of Justice is 9 years.

● The 15 judges are selected by the UN General Assembly and the UN Security Council from a list of people nominated by the national groups in the Permanent Court of Arbitration.

● The International Court of Justice was established in 1945 & headquartered in Hague.

53. Xenon is an element of which group in periodic table?

A. 12   B. 15

C. 18   D. 20

Ans. C

Sol. • Xenon is an element of Group 18 of Periodic Table.

• It has atomic number 54 & placed in Fifth Period. ^{132}Xe is its major isotope.

• It was discovered by Sir William Ramsay and Morris Travers in 1898.

• Xenon is used in flash lamps and arc lamps and as a general anaesthetic.

54. Who started the newspaper 'Somprakash'?

A. Raja Rammohan Rai   B. Dadabhai Naroji

C. WC Banerjee   D. Ishwarchandra Vidhyasagar

Ans. D

Sol. The Bengali newspaper 'Somprakash' was started by Ishwarchandra Vidhyasagar.

• Dwarkanath Vidyabhushan was the editor of this newspaper.

• The focus of his social reform was women especially on widow remarriage and child marriage, due to his efforts The Hindu Widows' Remarriage Act was enacted in 1856.

• Other books authored by IC Vidhyasagar are – Bodhadoy, Borno Porichoy, Kotha mala, etc.

55. The number of protons and neutrons in protium is respectively _____ & _____.

A. 1,1   B. 1,2

C. 1,0   D. 0,1

Ans. C

Sol. * The number of protons and neutrons in protium is one and zero respectively. In it one electron is also present.

* It is because it contains only one proton and no neutron in nucleus it is named as Protium. Protium is the most abundant form of hydrogen.

* Protium, Deuterium and Tritium are three most general isotopes of Hydrogen.

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

A. SEBI   B. Income Tax Department

C. RBI   D. Finance Ministry

Ans. C

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

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

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

57. Which of the following determines the nature of an enzyme?

A. Lipid   B. Vitamin

C. Protein   D. Carbohydrate

Ans. C

Sol. • All known Enzymes are proteins molecule.

• Enzymes are biological molecules that significantly speed up the rate of the chemical reactions that take place within cells.

• They are vital for life and serve a wide range of important functions in the body, such as aiding in digestion and metabolism.

58. What is the starter of a flourescent tubelight?

A. Transformer   B. Transistor

C. Capacitor   D. None

Ans. C

Sol. • Capacitor is the starter of a fluorescent tubelight.

• Capacitor and bimetallic contact inside the starter along with choke coil generate the high voltage across tube light to ionise the gas inside the tube and make it ON.

59. Which is the lower-most layer of the atmosphere?

A. Exosphere   B. Mesosphere

C. Stratosphere   D. Troposphere

Ans. D

Sol. Troposphere is the lower most layer of earth's atmosphere.

• It extends to 18km at Equator and 8kms at Poles.

• The temperature decreases as we go upward in Troposphere.

• The temperature decreases at the rate of 1 degree Celsius for every 165 m of height. This is called Normal Lapse Rate.

60. When is World Hypertension Day celebrated?

A. 23rd January   B. 17th May

C. 16th February   D. 14th April

Ans. B

Sol. • World Hypertension day is celebrated annually on the 17th May.

• It is celebrated to promote the public awareness of the importance of monitoring blood pressure with being aware of its natural levels.

• World Hypertension Day 2019 was celebrated with the theme 'Know Your Number'.

61. Musoorie hill station is located in which hill range?

   A. Aravalli Range
   B. Himalayan Range
   C. Vindhya Range
   D. Satpura Range

Ans. B

Sol.

- Mussorie hill station is situated in Uttrakhand.
- The hill station is in the foothills of the Garhwal Himalayan range.
- Mussoorie is popularly known as the Queen of the Hills.

62. The 'Instrument of Accession' of Jammu and Kashmir State into the Union of India was signed by _____.

   A. Sheikh Abdullah
   B. Farooq Abdullah
   C. Hari Singh
   D. Hanumant Singh

Ans. C

Sol. • The 'Instrument of Accession' of Jammu and Kashmir (J&K) state into the Union of India was signed by the Maharaja of J&K, Hari Singh.

• Pakistan entered into the standstill agreement but invaded Kashmir from north with an army of soldiers and tribesmen carrying weapons. In the early hours of 24th October, 1947, thousands of tribal pathans invaded Kashmir.

• On the very next day, Maharaja Hari Singh fled from Srinagar and arrived Jammu, where he signed the Instrument of Accession of J&K.

63. Which of the following element is not present in Gun Metal Alloy?

   A. Copper
   B. Zinc
   C. Tin
   D. Iron

Ans. D

Sol. 1. Iron is not present in Gun Metal Alloy. Gun Metal contains -88% copper, 8–10% tin, 2–4% zinc and 1% Lead.

2. It has applications in making statues, making of valves, pumps, pipes etc and in making of bearings.

3. It can withstand atmospheric, steam, and seawater corrosion and due to which it has diverse applications.

64. Vienna is located on the banks of which river?

   A. Thaya river
   B. Mur river
   C. Gurk river
   D. Danube river

Ans. D

Sol. • Vienna is the capital city of Austria.

• It is situated on the banks of the Danube river.

• Vienna is also described as Europe's cultural capital.

• The Danube river is the second-longest river in Europe.

• It begins in the Black Forest in Germany and flows east to the Danube Delta on the western coast of the Black Sea.

65. Who became the first Indian woman footballer to play professionally in the world?

    A. Aditi Chauhan   B. Anju Tamang

    C. Bala Devi   D. Sanju Yadav

Ans. C

Sol.

- In January 2020, Bala Devi from Manipur Police becomes the first Indian woman to become a professional footballer in the world.
- She has signed an 18-month deal with Scottish club Rangers Women's FC on 29th January 2020.
- She has the top scorer in the Indian Women's League for the past two seasons.
- She has also been named as All India Football Federation (AIFF) Women's Player of the Year twice, in 2015 and 2016.

66. Which of the following country is the largest producer of aluminum in the World?

    A. China   B. Italy

    C. India   D. Russia

Ans. A

Sol. • China is the world's largest aluminum producing country in the world.

• China's production of aluminum has surged from around 16 million metric tonnes in 2010 to a whopping 32 million metric tonnes 2017.

• Russia ranks second, Canada third and India fourth in the world in terms of aluminum production.

67. Vernacular press act was passed during the time of _____.

    A. Lord Ripon   B. Lord Lytton

    C. Lord Dufferin   D. Lord Curzon

Ans. B

Sol. • Vernacular press act was passed during the time of Lord Lytton.

• This act targeted the vernacular newspapers and had provisions related to restriction of news to be printed in newspapers, prior permission of British Administration for news publishing etc.

68. The 2024 Olympic Games logo unveiled in which city?

    A. Paris   B. Berlin

    C. Tokyo   D. Delhi

Ans. A

Sol. * 2024 Olympic Games logo unveiled in Paris.

* The 2024 Olympic is scheduled to take place from 26 July to 11 August 2024 in Paris, France.

* Paris will become second city after London to host Olympics three times.

* These will be the sixth Olympic Games hosted by France including three summer and three winter Olympic games.

69. Which Article of the Indian Constitution mentions about financial emergency?

    A. 360   B. 350

    C. 340   D. 330

Ans. A

Sol.

- Article 360: Provisions as to financial emergency.
- If the President is satisfied that a situation has arisen whereby the financial stability or credit of India or of any part of the territory thereof is threatened, he may by a Proclamation make a declaration to that effect.

70. On February 6, 2020, The President of India Ram Nath Kovind presented the International Gandhi Awards for Leprosy to_____.

    A. Dr. Ravi Sen   B. Surendra Bhargava

    C. Dr. N.S. Dharmashaktu   D. Dr. M.V. Subramanian

Ans. C

Sol. • The President of India Ram Nath Kovind presented the International Gandhi Awards for Leprosy to Dr. N.S. Dharmashaktu.

• President awarded him under the Individual category and The Leprosy Mission Trust under the institutional category on 6 February 2020.

• Followed by Brazil and Indonesia, India has the highest number of new leprosy cases in the world.

71. What is the focal length of a lens if its power is -4:

    A. 4 m   B. -0.25 m

    C. -40 m   D. -25 m

Ans. B

Sol. • Power of a lens is the reciprocal of focal length that is expressed in metres

i.e. $P = 1/f$, where P=Power and f= Focal length

-> $f = 1/P$

-> $f = 1/(-4) = -0.25$ m

72. What is full form of FRBMA?

    A. Financial Responsibility and Budget Management Act

    B. Financial Reinforcement and Budget Management Act

    C. Fiscal Responsibility and Budget Management Act

    D. Financial Responsibility and Budget Monitoring Act

Ans. C

Sol. •FRBMA stands fo rFiscal Responsibility and Budget Management Act

•The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) was passed in 2003 with an aim to reduce India's fiscal deficit, institutionalize financial discipline, improve macroeconomic management of budget and strengthen fiscal prudence.

73. The formation of Ammonia is known as _____.

    A. Contact Process   B. Haber Process

    C. Mitchell Process   D. Hydrogenation

Ans. B

Sol. • The formation of Ammonia is known as Haber Process. In this Process ammonia is produced from Hydrogen and Nitrogen.

    • Potassium hydroxide is added to it as a promoter which is basically a substance to increases its efficiency.

    • Ammonia is used in fertilizers, pharmaceuticals, fermentation & as a cleaner.

74. In January 2020, the Indian states namely Manipur, Meghalaya, and Tripura celebrated their Statehood Day on_____.

    A. 26 January   B. 21 January

    C. 18 January   D. 12 January

Ans. B

Sol. ● Indian states namely Manipur, Meghalaya, and Tripura celebrated their Statehood Day on 21 January.

    ● On 21 January 1972, all three states became full-fledged states under the North Eastern Region (Reorganization) Act, 1971.

75. Who won nobel prize for peace in 2019?

    A. Peter Handke   B. Abiy Ahmed

    C. Kazuo Ishiguro   D. Rainer Weiss

Ans. B

Sol. * Abiy Ahmed won nobel prize for peace in 2019.

    * Abiy Ahmed is Prime Minister of Federal Democratic Republic of Ethiopia since 2018.

    * Abiy was awarded the 2019 Nobel Peace Prize for his work in ending the 20-year post-war territorial stalemate between Ethiopia and Eritrea.

76. The members of the Rajya Sabha are elected by _____.

    A. All members of Legislative assembly

    B. All members of Legislative assembly and legislative council

    C. Elected members of the legislative assembly

    D. Elected members of the legislative council

Ans. C

Sol.

    • Members of Rajya Sabha are elected by the elected members of the Assemblies of States and Union territories in accordance with the system of proportional representation by means of the single transferable vote.

77. Tawa project is a river project, located in which state of India?

   A. Tamil Nadu   B. Andhra Pradesh

   C. Telangana   D. Madhya Pradesh

Ans. D

Sol. • Tawa Reservoir is a reservoir on the Tawa River in central India.

   • It is located in Itarsi of Hoshangabad District of Madhya Pradesh.

   • The reservoir was formed by the construction of the Tawa Dam.

   • Its construction was started in 1958 and was completed in 1978.

   • Tawa Reservoir forms the western boundary of Satpura National Park and Bori Wildlife Sanctuary.

78. Pravasi Bhartiya Kendra to be renamed as_____.

   A. Arun Jaitley Bhartiya Pravasi Kendra

   B. Sardar Patel Pravasi Kendra

   C. Sushma Swaraj Bhawan

   D. Swaraj Kendra

Ans. C

Sol. • In February 2020, the Government of India renamed Pravasi Bhartiya Kendra in New Delhi as Sushma Swaraj Bhawan.

   • Government has also renamed the Foreign Service Institute to Sushma Swaraj Institute of Foreign Service.

   • After Indira Gandhi, Sushma Swaraj was the second woman to hold the External Affairs Ministry. She was popularly known as the People's Minister.

79. Who was the First woman union minister?

   A. Vijayalakshmi Pandit   B. Amrit Kaur

   C. Gayatri Devi   D. Indira Gandhi

Ans. B

Sol. • Amrit Kaur was the First Woman Union Minister.

   • She was the first health minister of India and served for ten years in the capacity.

   • She was a part of Constituent Assembly and a member of Sub-Committee on Fundamental Rights and Sub-Committee on Minorities.

   • In 1950, she was elected the president of the World Health Assembly.

80. Kunwar Singh led the revolt of 1857 in which state?

   A. Maharashtra   B. Bengal

   C. Bihar   D. Punjab

Ans. C

Sol. * Kunwar Singh led the Indian Rebellion of 1857 in Bihar.

* He led a select band of armed soldiers against the troops under the command of the British East India Company.

* He was the chief organiser of the fight against the British in Bihar.

81. Knot is a unit of which of the following quantity?

A. Distance

B. Velocity

C. Force

D. Torque

Ans. B

Sol. Knot is a unit of speed which is equal to nautical mile per hour.

• The knot is a non-SI unit.

• The ISO standard symbol for the knot is kn.

• Nautical miles and knots are convenient units to use when navigating an aircraft or ship.

82. Who married the Lichchhavi princess Kumara Devi?

A. Srigupta

B. Samudragupta

C. Chandragupta I

D. Chandragupta II

Ans. C

Sol. Chandragupta I (AD 319-335) married the Lichchhavi princess Kumara Devi.

• He issued the coins in the joint names of himself, his queen Kumara Devi and the Lichchhavi nation which was known as 'Dinaras'.

• He also issued gold coins in his period.

• He was the first Gupta king to adopt the title of Maharajadhiraj.

• He was the first important king of Gupta dynasty.

83. Rh factor of blood groups was dicovered by _____.

A. Weiner and Treviranus

B. Landsteiner and Demock

C. Landsteiner and Johnson

D. Landsteiner and Wiener

Ans. D

Sol. • Rh factor of blood groups was dicovered by Landsteiner and Wiener in 1937.

• The term "Rh" was originally an abbreviation of "Rhesus factor."

•Since that time a number of distinct Rh antigens have been identified, but the first and most common one, called RhD, causes the most severe immune reaction and is the primary determinant of the Rh trait.

84. The recent Defence Expo,2020 held at which place?

A. Chennai

B. Pune

C. Bhopal

D. Lucknow

Ans. D

Sol. Recently the 11th edition of Defence Expo was held at Lucknow, from 5th to 9th February, 2020.

● The 10th edition of Def Expo was held in Chennai in 2018.

● The Defence Expo is a presentation and exhibition of new technologies, technological solutions, and it is attended by international dignitaries.

● One of the two Defence Industrial Corridors (DICs) of India is planned in Uttar Pradesh. The other DIC is proposed in Tamil Nadu.

● The fifth India Russia Military Industry Conference was held on the sidelines of the event.

85. In Rajiv Gandhi Khel Ratan Award, the cash incentive awarded in .... lakh?

A. 5   B. 7

C. 7.5   D. 9.5

Ans. C

Sol. In Rajiv Gandhi Khel Ratan award a cash incentive of 7.5 lakh rupees is awarded.

• Rajiv Gandhi Khel Ratan award is the highest sports honour in country.

• It was started in 1991-92, and in 2019 Bajrang punia and Deepa Malik was given the award.

• It is awarded annually by the Ministry of Youth Affairs and Sports.

• The first recipient of the award was Chess Grandmaster Viswanathan Anand.

86. In January 2020, which of the following state government launched the Amma Vodi scheme?

A. Tamil Nadu   B. Karnataka

C. Odisha   D. Andhra Pradesh

Ans. D

Sol. • On 9th January 2020, the Andhra Pradesh State government launched the Amma Vodi scheme.

• Amma Vodi can be translated as 'mother's lap' in Telugu.

• The scheme will be implemented on 26 January 2020.

• Under the scheme, mothers and guardians of school-going children from lower-income groups will receive financial assistance of Rs.15,000 annually.

87. The Shanghai Cooperation Organization has how many members?

A. 5   B. 6

C. 7   D. 8

Ans. D

Sol. The Shanghai Cooperation Organization has 8 members.

• The current members of SCO are given below as follows:

Kazakhstan

Kyrgyzstan

Tajikistan

Uzbekistan

Russia

China

India

Pakistan

• SCI was established in 2003 and its headquarters are located at Beijing.

• India and Pakistan joined SCO as full members on 9 June 2017 at a summit in Astana, Kazakhstan.

88. Saga Dawa festival is celebrated in which state?

A. Nagaland   B. Sikkim

C. Uttrakhand   D. Tamil Nadu

Ans. B

Sol. Saga Dawa festival is celebrated in Sikkim.

• It is celebrated on full moon day of Saga Dawa month of Tibetan Calendar.

• The Saga Dawa month falls between May and June and is known as 'Month of Merits'.

• The festival is celebrated to commemorate the birth, life and death of Buddha.

• The communities who celebrate this festival have to follow three teachings during the month- Generosity, Morality and Meditation.

89. What is the chemical name of slaked lime?

A. Calcium Nitrate   B. Sodium Chloride

C. Calcium Oxide   D. Calcium Hydroxide

Ans. D

Sol. • Calcium hydroxide is also called slaked lime. Its chemical formula is $Ca(OH)_2$.

• It is a colorless crystal or white powder, and produced when quicklime is mixed, or slaked with water.

90. 'British India Society' was founded by _____.

A. William Jones   B. William Adam

C. Raja Ram Mohan Roy   D. Dwarkanath Tagore

Ans. B

Sol. British India Society was founded in 1839 by William Adam.

• In 1841, the society started printing a newspaper 'British Indian Advocate'.

• With Efforts of George Thomson, Bengal British India Society was founded in 1843.

• The idea was to secure the welfare, and advance the interests of all classes.

91. The new coronavirus is officially named as _____ by World Health Organization (WHO).

   A. Covid-19   B. Virus-2020

   C. DFH-88   D. Corona-18

Ans. A

Sol. • The World Health Organization (WHO) has officially named the new coronavirus as Covid-19.

   • It is the shortened version of coronavirus disease 2019.

   • Coronavirus was first identified in the 1960s.

   • This virus can infect both humans and animals.

92. Human Development Index is released by?

   A. UNDP   B. WB

   C. IMF   D. WEF

Ans. A

Sol. The Human Development Index is developed by United Nations Development Programme.

   • It is a part of Human Development Report published by UNDP.

   • The focus of the 2019 Report is on 'Inequality in Human Development'.

   • Human development index is measured on the basis of three basic dimensions, which are-

   A long and healthy life,

   Access to knowledge, and

   A decent standard of living.

93. Which of the following state government will issue a separate identity card for the transgender community?

   A. Rajasthan   B. Kerala

   C. Maharashtra   D. Uttar Pradesh

Ans. A

Sol. • Rajasthan state government will issue a separate identity card for the transgender community.

   • The move aims to support the transgender community to get the benefit of government jobs and all government schemes.

   • The announcement was made by the Social Justice and Empowerment Minister Master Bhanwarlal Meghwal in February 2020.

94. Which of the following city is the capital of Hungary?

   A. Berlin   B. Riga

   C. Budhapest   D. Prague

Ans. C

Sol. * The capital of Hungary is Budapest.

    * Hungary is a European country. Budapest is the most populous city of Hungary,

    * The Great Hungarian Plain lies in it and it includes 56% of the country's total land.

    * It is an Alpha − global city with strengths in commerce, finance, media, art, fashion, research, technology, education, and entertainment.

95. The 43rd session of the governing council of the International Fund for Agricultural Development (IFAD) was held in _____.

    A. New Delhi   B. Tokyo

    C. Rome   D. Dhaka

Ans. C

Sol. • The 43rd session of the governing council of the International Fund for Agricultural Development (IFAD) was held in Rome, Italy.

    • It was held from 11-12 February 2020.

    • The theme of the session is "Investing in sustainable food systems to end hunger by 2030".

    • IFAD was established in 1974 at the World Food Conference.

96. What is the full form of HTTP?

    A. Hardware Transfer Protocol   B. Hypertext Transfer Printer

    C. Hyper tool Transfer Protocol   D. Hypertext Transfer Protocol

Ans. D

Sol. • The full form of HTTPS is Hypertext Transfer Protocol Secure.

    • HTTP is used for secure communication over a computer network. The protocol is also referred as TLS. Netscape Communications created HTTPS in 1994 for its Netscape Navigator web browser.

    • HTTPS connections were primarily used for payment transactions on the World Wide Web, e-mail and for sensitive transactions in corporate information systems.

97. What is the rank of India in Democracy Index 2019?

    A. 41st B. 42nd

    C. 58th D. 51st

Ans. D

Sol. ● India ranked 51st in the Democracy Index 2019.

    ● The index is based on the functioning of government, electoral process and pluralism, civil liberties, political participation, and political culture.

    ● Norway topped EIU's index with a score of 9.87.

    ● The Democracy Index is prepared by a UK-based company Economist Intelligence Unit (EIU).

98. Which of the following was NOT a part of the 'Navratna' at Vikram Aditya's court?

   A. Surdas   B. Vararuchi

   C. Kshapandka   D. Kalidasa

Ans. A

Sol. * The Navratans of Vikramaditya's court are nine novel courtiers representing different fields of excellence. Mughal emperor Akbar also had nine jewels or navaratan in his court.

   * The Navratans present in Vikramaditya's were -Amarasimha, Dhanvantari, Ghatakarpara, Kalidasa, Kshapanaka, Shanku, Varahamihira, Vararuchi and Vetala-Bhatta.

   * Kalidas was eminent classical Sanskrit scholar. Malavikagnimitram and Abhijnanasakuntalam are two of his best works.

   * Kālidāsa is the author of two epic poems, Raghuvaṃsa and Kumārasambhava.

99. Who is known as the father of Modern Hindi Literature?

   A. Premchand   B. Hazari Prasad Dwivedi

   C. Ramdhari Singh Dinkar   D. Bhartendu Harishchandra

Ans. D

Sol. Bhartendu Harishchandra is known as the father of modern Hindi Literature.

   • His major poetry creations are- Bhakta Sarvagya, Prem Malika, Madhumukul, Varsha Vinod, Vinay prem Pachasa etc.

   • The period from 1857 to 1900 is known as the Bharatendu era due to the vast literary contribution of Bharatendu.

   • He wrote: "Andher Nagari, Chaupat Raja, taka ser bhaaji, take ser khaja".

100. Which is the smallest cell in human body?

   A. Sperm cell   B. Ovum cell

   C. Nerve cell   D. Blood cell

Ans. A

Sol. • Sperm cell is the smallest cell in human body. Sperm cells are gametes that are produced in the testicular organ of male human being.

   • Sperm cells carry a total of 23 chromosomes that are a result of a process known as meiosis. The general morphology of sperm cells consists of the following parts:

   a) Distinctive head

   b) Midpiece (body)

   c) Tail

101. Wilson line is associated with which one of the following?

   A. Total steam consumption with respect to power output

   B. Supersonic flow of steam through a nozzle

   C. Nozzle flow with friction

   D. Supersaturated flow of steam through a nozzle

Ans. D

Sol. The limit of supersaturation is the Wilson line. The zone between the Wilson line and dry saturation line is called supersaturation field.

102. In the *EOQ* model, if the unit ordering cost is doubled, the *EOQ*

    A. is halved
    B. is doubled
    C. increases 1.414 times
    D. Decreases 1.414 times

Ans. C

Sol. $EOQ = \sqrt{\dfrac{2RC_o}{C_c}}$

    if $C_o = 2C_o$

    when $EOQ' = \sqrt{\dfrac{2R(2C_o)}{C_c}}$

    $\Rightarrow EOQ' = \sqrt{2} EOQ$

    $\Rightarrow EOQ' = 1.414 EOQ$

103. Phenomenon of flow separation is caused by which of the following reasons:

    A. Positive gradient of pressure.

    B. Negative gradient of pressure.

    C. when pressure reduce to local vapour pressure.

    D. when boundary layer thickness thins out to zero.

Ans. A

Sol. For boundary layer separation to take place $\dfrac{dp}{dx} > 0 \ \& \ \left(\dfrac{\partial u}{\partial y}\right)_{y=0} = 0$

104. For stability of a floating body

    (*M* = metacentre, *G* = centre of gravity and *B* = centre of buoyancy)

    A. *M* should coincide with *B* and *G*
    B. *M* should lie below *B* and *G*
    C. *M* should lie above *B* and *G*
    D. *M* should lie between and *G*

Ans. C

Sol. For stability of a body, it should have positive metacentric height i.e., *M* should lie above *B* and *G*.

105. Match **List-I** (Unconventional machining process) with **List-II** (Basic process) and select the correct answer using the codes given below the lists:

    List-I

    A). Electro polishing

    B). Electrochemical machining

    C). Abrasive jet machining

    D). Electrical discharge machining

    List-II

1. Thermal

2. Mechanical

3. Electro-chemical

4. Chemical

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

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

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

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

Ans. A

Sol. Electro polishing → Chemical

Electro chemical → Electrochemical machining

Abrasive jet → Mechanical machining

Electrical discharge → Thermal machining

106. Consider the following:

[1]. Crystal structure

[2]. Relative size

[3]. Chemical affinity

[4]. Valency

Which of these factors govern relative solubility of two metals in each other in the solid state?

A. 1, 2 and 3 only

B. 2, 3 and 4 only

C. 1, 2 and 4 only

D. 1, 2, 3 and 4 only

Ans. D

Sol. Factors govern relative solubility of two metals are:

[1]. Relative size

[2]. Valency

[3]. Chemical affinity

[4]. Crystal structure

107. For an ideal gas, the slope of the constant volume line in the T-S diagram is.

A. higher than the slope of the constant pressure line

B. lower than the slope of the constant pressure line

C. Equal to the slope of the constant pressure line

D. Equal to the slope of the constant temperature line

Ans. A

Sol. $\left(\dfrac{dT}{dS}\right)_V = \dfrac{T}{C_V}$

$\left(\dfrac{dT}{dS}\right)_P = \dfrac{T}{C_P}$

Since $C_P > C_V$

$\left(\dfrac{dT}{dS}\right)_V > \left(\dfrac{dT}{dS}\right)_P$

108. A stream of moist air at dry-bulb temperature of 40ºC and dew-point temperature of 25ºC passes through a water shower whose temperature is maintained at 20ºC. The stream of air will undergo a process of

   A. sensible cooling
   B. evaporative cooling
   C. cooling and humidification
   D. cooling and dehumidification

Ans. D

Sol. As the water temperature is below dew-point temperature of the moist air hence some water vapour will condense and hence the stream of air will undergo a process of cooling and dehumidification.

109. Which of the following force is not considered in Navier – Stoke's equation of motion

   A. Gravity force
   B. Pressure force
   C. Surface tension force
   D. Viscous force

Ans. C

Sol. Navier – Stoke's equation of motion

$M \times a = F_g + F_p + F_v$

Where;

F_g = gravity force

F_p = pressure force

F_v = viscous force

110. A fluid flowing through a circular pipe of radius R with a maximum velocity U_{max}, considering the flow to be laminar, what will be the velocity of the fluid at radius $\dfrac{R}{\sqrt{2}}$

   A. $\dfrac{U_{max}}{2}$
   B. U_{max}

   C. $2U_{max}$
   D. $\dfrac{U_{max}}{4}$

Ans. A

Sol. For laminar pipe flow

$U = U_{max}\left[1 - \dfrac{r^2}{R^2}\right]$

$r = \dfrac{R}{\sqrt{2}}$

$U = \dfrac{U_{max}}{2}$

111. A carnot engine operates between 27°C and 227°C. If the engine produces 250 kJ of work, the heat added is

   A. 500 Kj
   B. 600 kJ
   C. 625 kJ
   D. 650 kJ

Ans. C

Sol. For carnot engine,

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

$$\eta = 1 - \frac{300}{500}$$

$$= 0.4$$
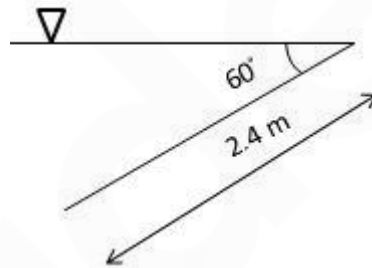
Now,

$$\eta = \frac{\text{work done}}{\text{Heat addition}}$$

$$\Rightarrow \text{Heat addition} = \frac{250 \times 5}{2}kJ = 625kJ$$

So, the correct option is (c).

112. Rectangular plate 0.75m × 2.4m is immersed in a liquid of relative density 0.85 with its 0.75m side horizontal and just at the water surface. If the plane of plate makes an angle of 60^0 with the horizontal, what is the approximate pressure force on one side of the plate?
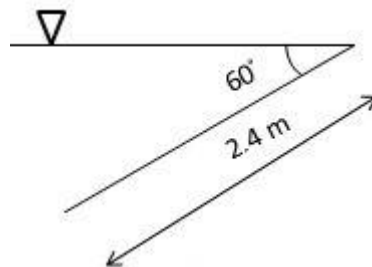

A. 7.80kN

B. 15.60kN

C. 18.00kN

D. 24.00kN

Ans. B

Sol.

Pressure force on one ide of the plate

$$= \omega A \overline{x}$$

$$= (0.85 \times 9.81) \times (0.75 \times 2.4) \times \left(\frac{2.4 \sin 60°}{2}\right)$$

$$= 15.60 \text{ kN}$$

113. Which one of the following is used to bring down the speed of an impulse steam turbine to practical limits?

   A. A centrifugal governor
   B. Compounding of the turbine
   C. A large flywheel
   D. A gear box

Ans. B

Sol. Velocity V = 44.72[$h_1 - h_0$]$^{1/2}$

∴ V will be very large for total enthalpy in a single stage.

∵ $V = \dfrac{\pi DN}{60}$

Thus rotational speed (N) will also be very large. Thus compounding is required.

114. Which of the following are the major characteristics of submerged arc welding?

   1. High welding speeds
   2. High deposition rates
   3. Low penetration
   4. Low cleanliness

   Select the correct answer using the code given below:

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

Ans. D

Sol. The SAW is used for the faster welding jobs. It is possible to use larger welding electrodes (12mm) as well as very high currents (4000A) so that very high metal deposition rates of the order of 20kg/h or more can be achieved with this process. Also very high welding speeds 5m/min are possible in SAW. Some submerged arc welding machines are able to weld plates of thickness as high as 75mm in butt joint in a single pass.

115. If the speed of the engine varies between 390 and 410 rpm in a cycle of operation, the coefficient fluctuation of speed will be

   A. 0.01
   B. 0.02
   C. 0.04
   D. 0.05

Ans. D

Sol. Max speed = 410

   Min speed = 390

   $C_s = \dfrac{\text{Range of speed}}{\text{Mean speed}}$

   $= \dfrac{410 - 390}{\left(\dfrac{490 + 310}{2}\right)} = 0.05$

116. If a wire rope is written as 7x25, then both 7 and 25 of wire rope numbers describes:

   A. number of strands and diameter of wire rope
   B. Number of strands and number of wires in a strand
   C. Number of wires and number of strands
   D. Gauge number of wire and number of strands

Ans. B

Sol. In a wire shown with 7×25, 7 indicates number of strands in the wire rope and 25 indicates number of wire in a strand.
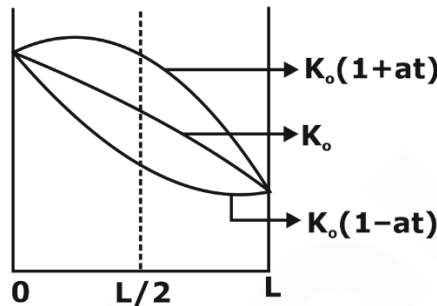
117. If the thermal conductivity of a material of wall varies as $k_0(1+at)$ then the temperature at the centre of the wall as compared to that in case of constant thermal conductivity will be

A. More
B. Less

C. Same
D. Possible in all as above

Ans. A

Sol. $K = K_0(1 + at)$

Where, K_0 = thermal conductivity at 0°C

So, temperature at centre of the wall is more.

118. In the boundary layer, the flow is

A. viscous and rotational
B. inviscid and irrotational

C. inviscid and rotational
D. viscous and irrotational

Ans. A

Sol. In boundary layer, the flow is viscous and rotational.

119. A gating ratio of 1 : 2 : 4 is used to design the gating system for magnesium alloy casting. This gating ratio refers to the cross-section areas of the various gating elements as given below:
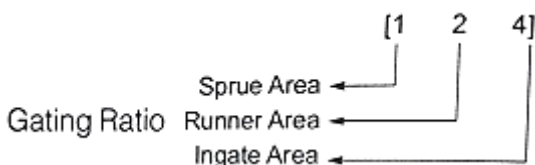
1). Down sprue

2). Runner bar

3). Ingates

The correct sequence of the above elements in the ratio 1 : 2 : 4 is

A. 1, 2 and 3
B. 1, 3 and 2

C. 2, 3 and 1
D. 3, 1 and 2

Ans. A

Sol.

120. Minimum value of fanning factor / friction coefficient in case of laminar pipe flow ?

A. 0.0040

B. 0.0053

C. 0.0160

D. 0.0080

Ans. D

Sol. In laminar flow of pipe

Friction factor; $f = 64/R_e$

Friction coefficient $f^I = f/4$

$f^I = 16/R_e$ (In laminar flow of pipe $R_e \leq 2000$)

minimum value of $f^I = (16/R_{e\ max})$

$f^I = 16/2000 = 0.008$

121. For a cylindrical rod with uniformly distributed heat sources, the thermal gradient dt/dr at half the radius location will be

A. one-fourth of that at the surface

B. one-half of that at the surface

C. twice of that at the surface

D. four times of that at the surface

Ans. B

Sol. The temperature distribution through a cylindrical rod with uniformly distributed heat sources is parabolic and prescribed as ,

$t = t_w + \dfrac{Qg}{4k}(R^2 - r^2)$

$\dfrac{dt}{dr} = \dfrac{Qg}{4k}(-2r)$

$\left(\dfrac{dt}{dr}\right)_{r=R} = \dfrac{Qg}{4k}(-2R)$

$\left(\dfrac{dt}{dr}\right) r = R/2 = \dfrac{Qg}{4k}(-2 \times R/2)$

Apparently

$\left(\dfrac{dt}{dr}\right) r = R/2 = (1/2)\left(\dfrac{dt}{dr}\right)_{r=R}$

122. Match List-I (Phenomenon) with List-II (Associated Dimensionless parameter) and select the correct answer using the code given below the lists:

List-I

A) Transient conduction

B) Forced convection

C) Mass transfer

D) Natural convection

List-II

1) Reynolds number

2) Grashoff number

3) Biot number

4) Match number

5) Sherwood number

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

Ans. C

Sol. A) Transient conduction : Biot number

B) Forced convection : Reynolds number

C) Mass transfer : Sherwood number

D) Natural convection : Grashoff number

123. The point of contraflexure in case of beams is:

A. The point, where shear force is zero

B. The point, where shear force changes its sign

C. The point, where bending moment is zero and changes its sign

D. The point, where no load acts on the beam.

Ans. C

Sol. At point of contraflexure, bending moment on beam is zero and changes its sign.

124. Consider the following statements:

(1). An ammonia absorption refrigerator has a COP more than 3 and is superior to vapour compression system

(2). Ammonia absorption machines are preferable where waste heat is available from an existing source.

(3). Absorption refrigerator has no moving part and hence needs little maintenance.

(4). The partial pressure of ammonia vapour varies, being high in the condenser and low in the evaporator.

Which of these statements are correct?

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

Ans. C

Sol. The COP of a absorption system is less than vapour compression system and hence it is inferior to vapour compression system interms of COP.

Remaining all statements are correct

125. A submarine is rolling under seawater whose radius of gyration is 12 m and period of oscillation of rolling of ship is 22 seconds then nearest metacentric height in metres is _____

A. 1.7
B. 1.2
C. 2
D. 2.3

Ans. B

Sol. Time period of ship T= 22 sec

$$T = 2\pi\sqrt{\frac{k^2}{gGm}}$$

$$22 = 2\pi\sqrt{\frac{12^2}{9.81 \times GM}}$$

GM = 1.197 m

= 1.2 m

126. A pure substance of mass 5kg at 5 MPa and 300 K has internal energy and enthalpy 15000 kJ and 20000 kJ respectively. The specific volume of the substance is _____ m^3/kg.

A. 2
B. 0.2
C. 200
D. 20

Ans. B

Sol. H = U + P.V

20000 = 15000 + (5x1000)x v

V = 1 m^3

specific volume, v = V/m = 1/5 = 0.2 m^3/kg

127. The buckling load for a column hinged at both ends is 10 kN. If the ends are fixed, the buckling load changes to

A. 40 kN
B. 2.5 kN
C. 5 kN
D. 20 kN

Ans. A

Sol. For hinged column

$$P = \frac{\pi^2}{l^2}EI = 10kN$$

For fixed column

$$P = \frac{4\pi^2}{l^2}EI = 4 \times 10 = 40kN$$

128. Relation between velocity and radius in Forced vortex motion is

A. Inversely proportional
B. Directly proportional
C. No relation exists
D. Constant

Ans. B

Sol. In forced vortex motion

$V = r \times \omega$

Example – vertical cylinder containing liquid rotated about its central axis

Hence $V \propto r$

In free vortex motion

$M \times v \times r = constant$

129. Mechanism of material removal for ECM machining

A. plastic shear

B. erosion

C. ionic dissolution

D. corrosion

Ans. C

Sol. In electrochemical machining electrolytes are used which causes ionic dissolution, to remove the material.

130. 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.

131. In a four-bar-linkage, if smallest link is S, longest link is L and other two connecting links are P and Q, then condition for rocker and rocker mechanism be:

A. s+l < p+q

B. s+l = p+ q

C. s+l ≥ p+ q

D. s+l > p+ q

Ans. D

Sol. In case of rocker and rocker mechanism, shortest link "S' is opposite to fixed link. So as per Grashoff's law

for double rocker mechanism: s+l > p+ q

132. Effective temperature depends on dry bulb temperature and

A. Wet bulb temperature only

B. Relative humidity

C. specific humidity

D. Wet bulb temperature, and air motion

Ans. D

Sol. Effective temperature is governed by the comfort feeling of a human. It is controlled by heat content (dry bulb temperature) and moisture content (wet bulb temperature) the motion of air is necessary to carry heat dissipated from the body.

133. A horizontal water jet of area 1 cm^2 and velocity 5 m/s strikes on a vertical plate which is moving with velocity 2 m/s towards the nozzle. The force acting on the plate is_____N.

A. 0.9

B. 4.9

C. 1.2

D. 2.0

Ans. B

Sol. F = ρQV$_r$

= ρQ(V + u)

= 1000 × A × (V + u)^2

= 1000 × 1 × 10^{-4} × (5 + 2)^2

= 4.9 N

134. Which one of the following statements is not correct for the exponential smoothing method of demand forecasting?

A. Demand for the most recent data is given more weightage

B. This method requires only the current demand and forecast demand

C. This method assigns weight to all the previous data

D. This method gives equal weightage to all the periods

Ans. D

Sol. The weight assigned to a previous period's demand decreases exponentially as that data sets older. Thus recent data receive a higher weight than does older demand data.
$F_t = αD_{t-1} + α(1 - α)D_{t-2} + ….$

135. What will be the value of Poisson's ratio, if the elasticity and rigidity of the material is 200 GPa and 66.67 GPa?

A. 0

B. 0.25

C. 0.5

D. 1

Ans. C

Sol. $\dfrac{E}{2G} = μ + 1$ μ = Poisson Ratio

$μ = \dfrac{E}{2G} - 1 = \dfrac{200}{2 \times 66.67} - 1$

= 1.49 – 1

= 0.49 approx

= 0.50

136. A refrigerator based on reversed Carnot cycle works between refrigeration and condenser temperature of -23°C and 27°C. If a cooling rate of 5 kW is desired, what will be the required power in kW?

A. 1

B. 2.5

C. 5

D. 25

Ans. A

Sol. $COP = \dfrac{T_L}{T_H - T_L}$

$COP = \dfrac{250}{300 - 250}$

$COP = 5$

Also, $COP = \dfrac{RE}{W_{in}}$

$5 = \dfrac{5}{W_{in}}$

$W_{in} = 1kW$

137. Match **List-I** (Quenching media) with **List-II** (Structure produced) and select the correct answer using the codes given below the lists:

List-I	List-II
[A]. Water	[1]. Coarse pearlite
[B]. Oil	[2]. Martensite
[C]. Air	[3]. Very fine pearlite
[D]. Furnace coal	[4]. Fine pearlite

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

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

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

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

Ans. B

Sol. **Water:**

The martensitic reaction begins during cooling when the austenite reaches the martensite start temperature (M_s) and the parent austenite becomes mechanically unstable. As the sample is quenched, an increasingly large percentage of the austenite transforms to martensite until the lower transformation temperature M_f is reached, at which time the transformation is completed.

Oil:

Oil quenching leads to a formation of relatively *fine* ferrite and *pearlite* grains in comparison to normal air and forced air *cooling*. Relatively *fine* ferrite, *pearlite* increase strength but decrease ductility. The *cooling* rate has a remarkable *effect* on the microstructure and mechanical properties at room temperature.

Air:

The eutectoid composition of austenite is approximately 0.76% carbon; steel with less carbon content (hypoeutectoid steel) will contain a corresponding proportion of relatively pure ferrite crystallites that do not participate in the eutectoid reaction and cannot transform into pearlite. Likewise steels with higher carbon content (hypereutectoid steels) will form cementite before reaching the eutectoid point.

Furnace coal:

The formation of pearlite also indicates that the transformation occurs sooner at low temperatures, which is an indication that it is controlled by the rate of nucleation. At low temperatures, nucleation occurs fast and grain growth is reduced (since it occurs by diffusion, which is hindered at low temperatures). This reduced grain growth leads to fine-grained microstructure (fine pearlite). At higher temperatures, diffusion allows for larger grain growth, thus leading to coarse pearlite.

138. Rockwell hardness test uses

    A. height of rebound
    B. surface area of indentation
    C. projected area of indentation
    D. depth of penetration of indenter

Ans. D

Sol. In Rockwell hardness test, indenter depth uses to measures the hardness.

139. A diesel engine has a compression ratio of 20 and cut-off takes place at 10% of the stroke. What is the cut-off ratio?

    A. 1.80
    B. 1.85
    C. 1.90
    D. 2.9

Ans. D

Sol. given,

r = 20

cutoff takes place at 10% of stroke volume

$V_3 - V_2$ = % of stroke $(V_2 - V_1)$

$r_c - 1 = \%(r - 1)$

$r_c - 1 = 0.1(20 - 1)$

$r_c = 2.9$

140. For a general two dimensional stress system, what are the coordinate of the centre of Mohr's circle?

    A. $\frac{\sigma_x - \sigma_y}{2}, 0$
    B. $0, \frac{\sigma_x + \sigma_y}{2}$
    C. $\frac{\sigma_x + \sigma_y}{2}, 0$
    D. $0, \frac{\sigma_x - \sigma_y}{2}$

Ans. C

Sol. The general equation of Mohr's circle

$$\left(\sigma_0 - \frac{\sigma_x + \sigma_y}{2}\right)^2 + \tau_0^2 = \left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2$$

$$\text{centre} = \left(\frac{\sigma_x + \sigma_y}{2}, 0\right)$$

$$\text{Radius} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

141. Consider the following statements

Volumetric efficiency of a reciprocating air compressor increases with

1) increase in clearance ratio

2) decrease in delivery pressure.

3) multi-staging

Which of these statements is/are correct?

A. Only 1 and 2   B. Only 2 and 3

C. Only 3   D. 1, 2 and 3

Ans. B

Sol. Multi-stage compression is used to improved the overall volumetric efficiency.

$$\eta_v = 1 + C - C\left(\frac{P_2}{P_1}\right)^{1/n}$$

By decreasing the delivery pressure (P_2) the volumetric efficiency of a reciprocating air compressor can be increased.

142. What will be the thermal stress (in MPa)developed in a rod having a diameter of 4 cm and length of 2 m. If experiences heating from temperature 50°C to 200°C. The coefficient of thermal expansion is

α = 10 × 10^{-6}/°C and young's modulus is 250 GPa?

A. 300   B. 325

C. 350   D. 375

Ans. D

Sol. thermal expansion(LΔ) =α LΔT

σ = Eε

σ=250x1000x150x10 × 10^{-6}

σ=375 MPa

143. Work done is zero for the following process

A. constant volume   B. free expansion

C. throttling   D. all of the above

Ans. D

Sol. For constant volume pressure

W = ∫PdV Since dV = 0 W = 0 For free expansion

W = 0

Also for throttling process

W = 0

144. Change in internal energy of a system consisting of ideal gas is zero if _____ is constant

A. Entropy

B. Temperature

C. work

D. mass

Ans. B

Sol. In Isothermal process the temperature is constant. The internal energy of ideal gas only depends on temperature. Hence, the internal energy change is zero.

145. A fixed bar PQ is subjected to loading as shown at the point R. What is the ratio of reaction at P to that at Q?
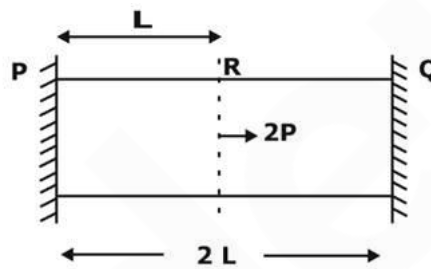
A. 1:0.5

B. 2:1

C. 1:2

D. 1:1

Ans. D

Sol. $R_P + R_Q = 2P$

$\Delta L = 0$

$\Delta L = \dfrac{R_P L}{AE} + \dfrac{(R_P - 2P)}{AE}L = 0$

$\Rightarrow R_P + R_P - 2P = 0$

$R_P = P$

$R_Q = P$

$\therefore \dfrac{R_P}{R_Q} = 1:1$

146. 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.

147. According to Carnot principles, if two engines, one reversible and other irreversible are operating between same temperature limits. Then which of the following statement is correct?

A. $\eta_{irreversible} > \eta_{reversible}$

B. $\eta_{irreversible} = \eta_{reversible}$

C. $\eta_{irreversible} < \eta_{reversible}$

D. Depend upon numerical values of temperature limits used

Ans. C

Sol. According to Carnot principles, if two engines, one reversible and other irreversible are operating between same temperature limits, then $\eta_{irreversible} < \eta_{reversible}$

148. In an axial flow compressor, stalling is the phenomenon of

A. Air motion at sonic velocity

B. Air stream blocking the passage

C. Reversed flow of air

D. Air stream not following the blade contour

Ans. D

Sol. Stalling is the phenomenon in which air stream fails to follow the blade contour.

149. An ideal closed-cycle gas turbine plant is working between the temperatures 927 °C and 27 °C using air as working fluid. The pressure ratio for maximum output is

A. 11.3   B. 13.3

C. 15.3   D. 17.3

Ans. A

Sol. From Brayton cycle,

$$W_{net} = mC_p \left[T_3 \left(1 - \left(\frac{1}{r} \right)^{\frac{\gamma-1}{\gamma}} \right) - T_1 \left((r_p)^{\frac{\gamma-1}{\gamma}} - 1 \right) \right]$$

For optimum pressure ratio, $\dfrac{dw_{net}}{dr_p} = 0$.

$$(r_p)_{opt} = \left(\frac{T_{max}}{T_{min}} \right)^{\frac{\gamma}{2(\gamma-1)}} = \left(\frac{1200}{300} \right)^{\frac{1.4}{2 \times (1.4-1)}}$$

$$\Rightarrow (r_p)_{opt} = (4) \times 2\sqrt{2} = 11.31$$

150. Two shafts P & Q are of same material and P is thrice the diameter of Q. The torque that an be transmitted by P is

    A. 3 times of Q
    B. 6 times of Q
    C. 9 times of Q
    D. 27 times of Q

Ans. D

Sol. Since material of the shaft is same, i.e. shear stress is same

$T \propto d^3$

$$\frac{T_P}{T_Q} = \frac{d_P^3}{d_Q^3} = \frac{3^3}{1^3} = 27$$

$T_P = 27 T_Q$

151. First law of thermodynamics furnishes the relationship between

    A. Heat & work
    B. heat, work & properties of the system
    C. Various properties of the system
    D. none of these

Ans. B

Sol. The first law of thermodynamics is actually the law of conservation of energy stated in a form most useful in thermodynamics. The first law gives the relationship between heat transfer, work done, and the change in internal energy of a system.

152. Coefficient of discharge (C_d) for venturi meter is

    A. 0.95 – 0.99
    B. 0.61 – 0.65
    C. 0.91 – 0.95
    D. 0.8 – 0.9

Ans. A

Sol. Coefficient of discharge (C_d) for venturi meter is 0.95 to 0.99.

153. 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.**

154. Stalling of blades in axial-flow compressors is the phenomenon of

    A. air stream blocking the passage

    B. motion of air at sonic velocity

    C. unsteady periodic and reverse flow

    D. air stream not able to flow over the blade contour

Ans. D

Sol. When air steam does not follow the contour of the blade stalling occurs.

155. Which of the following hydraulic turbines are reaction turbines?

    1) Francis

    2) Kaplan

    3) Propeller

    A. 1, 2 and 3   B. 1 and 2 only

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

Ans. A

Sol. All Francis, Kaplan and Propeller are of reaction turbine type.

    In a reaction turbine both pressure energy and kinetic energy are available at inlet.

156. In shell molding casting

    A. molten metal gets poured out when thin shell solidifies into mold

    B. mold is thin shell of sand that is binded by thermosetting resin

    C. pattern acts as shell instead of solid form

    D. artificial sea shells are made from casting process

Ans. B

Sol. Shell molding casting is expendable mold casting process which uses resin covered sand to form mold.

157. The maximum efficiency of power transmission through pipe is

    A. 50%   B. 56.7%

    C. 66.67%   D. 63.2%

Ans. C

Sol. For maximum power transmission,

    Available head, $H = 3 \times h_L$

    $$\eta = \frac{\text{actual head available}}{\text{theoretical head available}}$$

    $$= \frac{H - h_L}{H}$$

 $$\frac{3h_L - h_L}{3h_L} = 66.67\%$$

158. First law of thermodynamics is also known as

A. Law of conservation of energy   B. Law of degradation of energy

C. Both   D. None of these

Ans. A

Sol. The first law of thermodynamics states that the energy can neither be created nor be destroyed. It can only get transformed from one form to another form i.e Energy is conserved
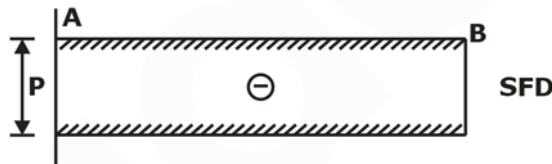
159. For the cantilever beam shown below, calculate the maximum shear stress developed:
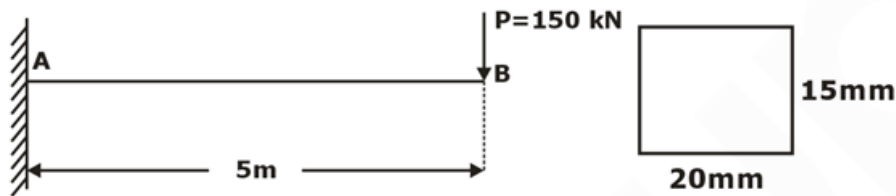
A. 450 MPa   B. 500 MPa

C. 750 MPa   D. 800 MPa

Ans. C

Sol. Shear force diagram of beam will be:

Hence, max shear force acting on beam = P (only magnitude)

As beam is of rectangular cross-section,

∴ max shear stress, $\tau_{max} = \dfrac{3}{2}(\tau_{avg}) = \dfrac{3}{2}\left[\dfrac{P}{\text{area of beam}}\right] = \dfrac{3}{2}\left[\dfrac{P}{20 \times 15}\right]$

$= \dfrac{3}{2} \times \dfrac{150 \times 10^3}{20 \times 15} = 750 \text{N}/\text{mm}^2 = 750 \text{MPa}$

160. Which of the following is not an essential component of any refrigeration system, where refrigeration effect is produced by vapourization of refrigerant?

A. Compressor   B. Condenser

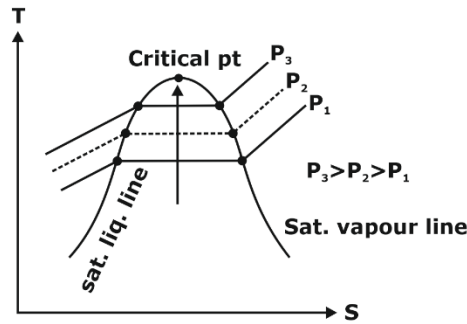C. Evaporator   D. Expansion device

Ans. A

Sol. Compressor is not used in Vapour absorption refrigeration system.

So option 1 is the correct answer.

161. In Taylor's tool life equation $VT^n = C$, the constants n and C depend upon
    1. Work piece material
    2. Tool material
    3. cutting condition

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

Ans. A

Sol. In Taylor tool life equation

VT^n = Constant

n and C depend on tool material, work material and cutting condition.

162. Shear force diagram of a cantilever beam subjected to uniformly varying load is

    A. Linear   B. Parabolic
    C. Cubic   D. Rectangle

Ans. B

Sol. Shape of shear force diagram for cantilever beam

For point load = Rectangle

For uniformly distributed load = Linear

For uniformly varying load = Parabolic

163. A gas turbine operating on Brayton cycle has the maximum temperature of 1200 k and the minimum temperature of 300 k . the cycle efficiency for the maximum work capacity will be

    A. 75%   B. 60%
    C. 50%   D. 25%

Ans. C

Sol. The Maximum net work is obtained when the pressure ration is equal to the square root of maximum theoretical pressure ratio.

$r_p = \sqrt{r_{p\,max}}$

So, $\eta_{max\ network} = 1 - \sqrt{\dfrac{T_{min}}{T_{max}}}$

$= 1 - \sqrt{\dfrac{300}{1200}}$

$= 1 - \dfrac{1}{2} = 50\%$

164. Which one of the following statements is correct when saturation pressure of water vapour increases?

    A. Saturation temperature decreases
    B. Enthalphy of evaporation decreases
    C. Enthalpy of evaporation increases
    D. Specific volume change of phase increases

Ans. B

Sol.

165. 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.
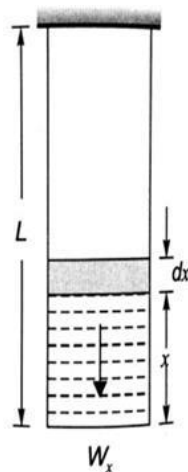
So, the correct option is (b).

166. Which one of the following expresses the total elongation of the bar of length L with the constant cross-section of A and modulus of elasticity E hanging vertically and subject to its own weight W?

A. $\dfrac{WL}{AE}$

B. $\dfrac{WL}{2AE}$

C. $\dfrac{2WL}{AE}$

D. $\dfrac{WL}{4AE}$

Ans. B

Sol. Deflection of elemental length 'dx'

$$d_\Delta = \frac{W_x \cdot d_x}{AE}$$

Total defection

$$\Delta = \int_0^2 \frac{W_x \cdot d_x}{AE}$$

$$\Delta = \frac{\gamma l^2}{2E} = \frac{W}{V} \times \frac{L^2}{2E}$$

$$\Delta = \frac{W}{AL} \times \frac{L^2}{2E}$$

$$\Delta = \frac{W}{2AE}$$

167. What is the slope of isobaric lines on mollier chart?

    A. Absolute Temperature   B. pressure

    C. Volume   D. Enthalpy

Ans. A

Sol. We know Maxwell equation,

dh = Tds = Vdp

$\left(\dfrac{dh}{ds}\right)_p = T$ For isobaric

168. A Carnot engine rejects 40% of absorbed heat to a sink at 27 °C. The temperature of the heat source is.

    A. 100 °C   B. 750 ° C

    C. 1023 °C   D. 477 ° C

Ans. D

Sol. $Q_R = 0.4\ Q_S \Rightarrow W = Q_S - Q_R$

$\Rightarrow W = 0.6\ Q_S \Rightarrow \eta = \dfrac{W}{Q_s} = 1 - \dfrac{300}{T}$

$T = \dfrac{300}{0.4}$

= 750K

∴T = 750 − 273 = 477 °C

169. If 3000 kj/kg heat is added to the system & work done on the system is 6000 kj/kg, then change in internal energy is given by

    A. 9000 kj/kg   B. 3000 kj/kg

    C. -3000 kj/kg   D. None of these

Ans. A

Sol. We know that heat added to the system is taken as positive and work done on the system is taken as negative,

Here Q = 3000 kj/kg, W = -6000 kj/kg

According to first law of thermodynamics,

Q = ΔU + W

3000 = ΔU − 6000

ΔU = 9000 kj/kg

170. In vapor compression cycle, under which process the refrigerant leaves expansion valve in partially liquid and gaseous state?

A. Condensation

B. Expansion

C. Evaporation/Cooling

D. Compression

Ans. B

Sol. During the expansion process, the liquid refrigerant on entering in expansion valve results in falling of temperature and pressure. Further the refrigerant leaves expansion valve in partially liquid and gaseous state.

171. Match **List-I** (theory of Failure) with **List-II** (predicted Ratio of Shear Stress to Direct Stress at yield Condition for Steel Specimen) select the correct answer using the code given below the lists:

List-I

A). Maximum shear Stress theory

B). Maximum energy of distortion theory

C). Maximum principle stress theory

D). Maximum principle strain theory

List-II

1). 1.0

2). 0.77

3). 0.577

4). 0.50

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

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

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

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

Ans. B

Sol.

TOF	$\left(\dfrac{Sys}{Syt}\right)$
MSST	0.5
MDET	0.577
MPST	1.0
MPST	0.77

172. Flank wear occurs mainly on which of the following:

   A. Nose part and top face

   B. Cutting edge only

   C. Nose part, front relief face and side relief face of the cutting tool

   D. Face of the cutting tool at a short distance from the cutting edge

Ans. C

Sol. Flank wear mainly occurs on the tool nose and front and side relief faces. It occurs due to abrasion between the tool flank and the workpiece and excessive heat generated as a result of the same.

173. The thickness of boundary layer in a turbulent flow is

   A. $\dfrac{5x}{\sqrt{R_{NX}}}$

   B. $\dfrac{5.835x}{\sqrt{R_{NX}}}$

   C. $\dfrac{0.377x}{(R_{NX})^{\frac{1}{5}}}$

   D. $\dfrac{5.377x}{(R_{NX})^{\frac{1}{5}}}$

Ans. C

Sol. The thickness of boundary layer for turbulent flow when Reynolds number varies from $5*10^5$ to 10^7 is $\dfrac{0.377x}{(R_{NX})^{\frac{1}{5}}}$

174. Which one of the following express the reversible work done by the system (Steady flow) between states 1 and 2?

   A. $\displaystyle\int_1^2 pdv$

   B. $-\displaystyle\int_1^2 Vdp$

   C. $-\displaystyle\int_1^2 pdv$

   D. $\displaystyle\int_1^2 Vdp$

Ans. B

Sol. For steady flow process, reversible work is given by $-\displaystyle\int_1^2 Vdp$

175. Choose the wrong statement about the regenerative vapour power cycle employing bled steam form feed water heating:

   A. It increases the thermodynamic efficiency of the cycle.

   B. The thermal stresses in the boiler are reduced.

   C. Work done per kg of steam is increased.

   D. It requires boiler of large capacity for same level of power output as compared to a simple Rankine cycle.

Ans. C

Sol. A regenerative vapor power cycle improves thermal efficiency, reduces thermal stresses in the boiler, reduces heat rate, reduces condenser size, requires boiler of larger capacity. But it decreases the work done per kg of steam.

176. A bar produces a lateral strain of magnitude -60 × 10⁻⁵ when subjected to tensile stress of magnitude 300 MPa along the axial direction. What is the elastic modulus of the material, if the Poisson ratio is 0.3?

A. 100GPa   B. 150GPa

C. 200GPa   D. 400GPa

Ans. B

Sol. $\dfrac{-\mu\sigma}{E}$ = Lateral straion

$= \dfrac{-0.3 \times 300 \times 10^6}{E} = -60 \times 10^{-5}$

$= E = \dfrac{0.3 \times 300 \times 10^6}{61 \times 10^{-5}}$

= 150 × 10⁹ Pa

= 150 GPa

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

List-I

A). Worm gear

B). Spur gear

C). Herringbone gear

D). Spiral bevel gear

List-II

1). Impose no thrust load on the shaft

2). To transmit power between two non-intersecting shafts which are perpendicular to each other

3). To transmit power when the shafts are parallel

4). To transmit power when the shafts are at right angle to one another

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

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

Ans. B

Sol. **A). Worm gear** → To transit power between two non-intersecting shafts which are perpendicular to each other.

B). Spur gear → To transmit power when the shaft are parallel

C). Herringbone gear → imposeno thrust load on the shaft

D). Spiral bevel gear → To transmit power when the shaft are at right angles to one another.

178. An engine is required 150 kW brake power. The mechanical efficiency of the engine is 75%. The frictional power is

A. 150 kW
B. 200 kW
C. 50 kW
D. 25 kW

Ans. C

Sol. Frictional power (FP) is

FP = IP − BP

$$\eta_{mech} = \frac{BP}{IP}$$

$$IP = \frac{150}{0.75} = 200 \text{ kW}$$

FP = 200 − 150 = 50kW

179. In a normal shock wave in one dimensional flow

A. the entropy remains constant

B. the entropy increases across the shock

C. the entropy decreases across the shock

D. the velocity, pressure and density increase across the shock

Ans. B

Sol. The normal shock always involves a change from supersonic to subsonic speed with a consequent pressure rise and never the reverse. By second law, entropy always increases during irreversible adiabatic change. The entropy increases across the shock.

180. The pressure in meters of oil of specific gravity 0.9 equivalent to 90 m of water is

A. 90 m
B. 100 m
C. 80 m
D. 95 m

Ans. B

Sol. 0.9×h×1000×9.81 = 90×1000×9.81

h = 100 m

181. Maximum shear stress developed on the surface of a solid circular shaft under pure torsion is 240 MPa. If the shaft diameter is doubled, then what is the maximum shear stress developed corresponding to the same torque?

A. 120 MPa
B. 60 MPa
C. 30 MPa
D. 15 MPa

Ans. C

Sol. Maximum shear stress

$$= \frac{16T}{\pi d^3} = 240 MPa = \tau$$

Maximum shear stress developed when diameter is doubled

$$= \frac{16\tau}{\pi(2d)^3} = \frac{1}{8}\left(\frac{16T}{\pi d^3}\right) = \frac{\tau}{8}$$

$$= \frac{240}{8} = 30 MPa$$

182. It is required to cut screw threads with double start and 2mm pitch on a lathe having lead screw pitch of 6mm. What is the speed ratio between lathe spindle and lead screw?

A. 1 : 3

B. 3 : 1

C. 2 : 3

D. 3 : 2

Ans. D

Sol. Because, it is double start

lead of screw threads load

= n × p = 2 × 2 = 4 mm

[n = number of start]

p = pitch

∴ $\dfrac{\text{speed of lathe spindle}}{\text{speed of lead screw}} = \dfrac{6}{4} = \dfrac{3}{2}$

183. The function of condenser in thermal power plant is

A. To act as reservoir to receive steam for turbine

B. To condense steam into condensate to be reused again

C. To create vacuum

D. All the above

Ans. D

Sol. In thermal power plants, the purpose of a surface condenser is to condense the exhaust steam from a steam turbine to obtain maximum efficiency, and also to convert the turbine exhaust steam into pure water (referred to as steam condensate) so that it may be reused in the steam generator or boiler as boiler feed water.

184. A satellite floats in deep space with very high velocity. It will continuoiusly lose heat by

A. convection

B. conduction and convection

C. radiation

D. radiation and convection

Ans. C

Sol. As there will be no mass surrounding satellite it will lose heat by radiation only.

185. Tool life is affected mainly with

A. Feed

B. Depth of cut

C. Coolant

D. Cutting speed

Ans. D

Sol. Sequence of parameters affecting tool life is:

cutting speed>feed>depth of cut

186. In a Spring-Mass-Damper system, if mass is m, viscous damping constant is c, stiffness is k and applied force is F(t) in case of free damped vibration, then the correct expression is:

A. c = 2ςm/ώ

B. c = 2ς/mώ

C. c = 2ς+mώ

D. c = 2ςmώ

Ans. D

Sol. In case of free damped vibration $S = -c/2m \pm \sqrt{(c/2m)^2 - k/m}$

Now the natural un-damped resonant angular frequency will be $\dot{\omega} = \sqrt{k/m}$

Critical damping constant $c_c = 2m\dot{\omega}$

Hence the ratio of critical damping system $\varsigma = c / c_c$

So, viscous damping constant $c = 2\varsigma m\dot{\omega}$

187. The fouling factor in heat exchanger is defined as

A. $R_f = U_{dirty} - U_{clean}$

B. $R_f = \dfrac{1}{U_{dirty}} - \dfrac{1}{U_{clean}}$

C. $\dfrac{1}{R_f} = \dfrac{1}{U_{dirty}} - \dfrac{1}{U_{clean}}$

D. $\dfrac{1}{R_f} = U_{dirty} - U_{clean}$

Ans. B

Sol. The resistance due to fouling $= R_f$

$\therefore \dfrac{1}{U_{dirty}} = \dfrac{1}{U_{clean}} + \dfrac{1}{\dfrac{1}{R_f}}$

$\therefore R_f = \dfrac{1}{U_{dirty}} - \dfrac{1}{U_{clean}}$

188. A non-prismatic square cross-sectional bar tapers from a square of side 50mm to a square of side 10mm over a length of 0.5m. If this bar is subjected to an axial load of 2kN and the modulus of elasticity of material is E = 200GPa, then the change in length of bar is

A. 0.025mm

B. 0.5mm

C. 0.01mm

D. 0.05mm

Ans. C

Sol. Change in length of square taper bar = PL/abE

Where a and b are the side lengths of square.

Therefore, change in length = $\dfrac{2000 \times 500}{50 \times 10 \times 200 \times 1000} = 0.01mm$

189. What is the direction of the Coriolis component of acceleration in a slotted lever- crank mechanism?

A. Along the sliding velocity vector

B. Along the direction of the crank

C. Along a line rotated 90^0 from the sliding velocity vector in a direction opposite to the angular velocity of the slotted lever

D. Along a line rotated 90^0 from the sliding velocity vector in a direction same as that of the angular velocity of the slotted lever
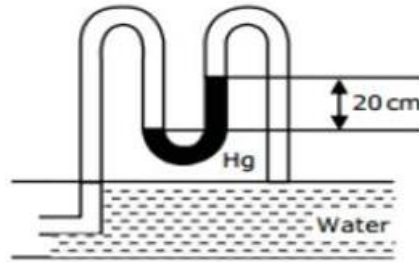
Ans. D

Sol. $a_{coriolis} = 2\omega \times v$

The direction of the Coriolis component of acceleration along a line rotated 90^0 from the sliding velocity vector in a direction same as that of the angular velocity of the slotted lever.

190. A pitot tube is used to find velocity at a point inside the tube and connected to u-tube manometer as shown in figure find velocity of fluid at 'A' in (m/s).

A. 4.55   B. 7.03

C. 8.89   D. 10.44

Ans. B

Sol. $H = X\left(\dfrac{S_m}{S} - 1\right)$

$= \dfrac{20}{100}(13.6 - 1) = 2.52\,m$

$V = \sqrt{2gh} = \sqrt{2 \times 9.81 \times 2.52}$

$V = 7\ m/s$

191. A spur gear transmits 10 kW at a pitch line velocity of 10 m/s; driving gear has a diameter of 1.0m. find the tangential force between the driver and the follower, and the transmitted torque respectively.

A. 1 kN and 0.5 kN-m   B. 10 kN and 5 kN-m

C. 0.5kN and 0.25 kN-m   D. 1 kN and 1 kN-m

Ans. A

Sol. Power transmitted = force × velocity

$\Rightarrow 10 \times 10^3 =$ Force × 10

$\Rightarrow$Force $= \dfrac{10 \times 10^3}{10} = 1000N$

Torque transmitted

$=$ Force $\times \dfrac{\text{diameter}}{2} = 1000N$

$= 1000 \times \dfrac{1}{2} = 1000 \times 0.5$

$= 500\ N\text{-}m = 0.5\ kN\text{-}m$

192. Which one of the following expxresses the maximum blade efficiency of a Parson's turbine?

A. $\dfrac{2\cos^2 \alpha}{1 + \cos^2 \alpha}$

B. $\dfrac{\cos^2 \alpha}{1 + 2\cos^2 \alpha}$

C. $\dfrac{\cos \alpha}{1 + \cos^2 \alpha}$

D. $\dfrac{\cos \alpha}{2}$

Where $\propto$ is the jet angle at the entrance.

Ans. A

Sol. Maximum efficiency of Parson's reaction turbine

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

193. In a single stage reciprocating air compressor, the work done on air to compress it from suction pressure to delivery pressure will be minimum when the compression is

A. Isothermal process

B. Adiabatic process

C. Polytropic process

D. Constant pressure process

Ans. A

Sol. By compressing the work using isothermal process, we have to provide minimum work.

194. In a single server queuing system with arrival rate of 'λ' and mean service time of 'μ' the expected number of customers in the system is $\dfrac{\lambda}{(\mu - \lambda)}$ What is the expected waiting time per customer in the system?

A. $\dfrac{\lambda^2}{(\mu - \lambda)}$

B. $(\lambda + 1)/\lambda$

C. $\dfrac{1}{\mu - \lambda}$

D. $\dfrac{(\mu - \lambda)}{\lambda}$

Ans. C

Sol. Expected waiting time per customer in the system

$$= W_s = \dfrac{L_s}{\lambda}$$

$$= \left(\dfrac{\lambda}{\mu - \lambda}\right)\left(\dfrac{1}{\lambda}\right) = \dfrac{1}{\mu - \lambda}$$

195. Which of the following method use to measure the toughness of a part?

A. Charpy testing

B. Izod testing

C. Drop weight testing

D. All of the above

Ans. D

Sol. All the above given methods are used to measure the toughness of a part

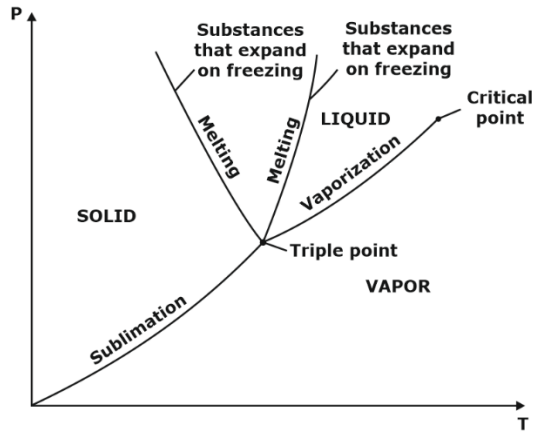196. The slope of sublimation curve on P-T diagram for all substances is

A. unity

B. equal to zero

C. positive

D. negative

Ans. C

Sol.

As shown in the diagram, irrespective of substance sublimation curve always has positive slope.

197. Reheat between multistage expansions in Joule cycle increases
    1) Overall work output.
    2) The work ratio.
    3) The thermal efficiency.
    Which of the above are correct?
    A. 1, 2 and 3   B. 1 and 2 only
   C. 2 and 3 only   D. 1 and 3 only

Ans. B

Sol. The thermal efficiency depends on the heat supplied also. Because the efficiency is the ratio of network done to the heat supplied. The thermal efficiency may increase or decrease.

198. A three cylinder radial engine driven by a common crank of radius r has the cylinders spaced at 120° among each other. The mass of the reciprocating parts per cylinder is m kg. The primary unbalance force at a crank shaft speed of ω rad/s is

    A. $\frac{3}{2}m\omega^2 r$ B. $3\ m\omega^2 r$

    C. $\frac{1}{3}m\omega^2 r$ D. $m\omega^2 r$

Ans. A

Sol.
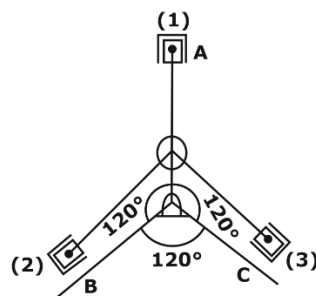
For cylinder (1)

Position of direct crank = angle OA

Position of reverse crank = angle OA

For cylinder (2)

Position of direct crank = angle OA

Position of reverse crank = angle OC

For cylinder (3)

Position of direct crank = angle OA

Position of reverse crank = angle OB

The reverse crank of three cylinder form a balanced system as

$$\cos 0^\circ + \cos 120 + \cos 240 = 0$$

The direct crank of three cylinder gives

Primary force $= 3 \times \dfrac{m}{2} r\omega^2$ along cylinder (1)

199. A beam having rectangular cross-section is subjected to an external loading. The average shear stress developed due to external loading at particular cross-section is τ_{avg}. What is the maximum shear stress developed at the same cross-section due to the same loading?

A. $\dfrac{1}{2}\tau_{avg}$

B. τ_{avg}

C. $\dfrac{3}{2}\tau_{avg}$

D. $2\tau_{avg}$

Ans. C

Sol. Shear stress developed is given by

$$\tau = \frac{F}{2I}\left(\frac{a^2}{4} - y^2\right) = \frac{F}{2 \times \frac{bd^3}{12}}\left(\frac{a^2}{4} - y^2\right)$$

$$\tau_{max} = \frac{6F}{bd^3}\left(\frac{d^2}{4}\right) = \frac{6F}{4bd} = \frac{3}{2} = \frac{F}{bd}$$

$$\therefore \tau_{max} = \frac{3}{2}\tau_{avg}$$

200. The cycle of refrigeration is known as Reverse Carnot Cycle as:

A. heat flows from low temperature reservoir to high temperature reservoir

B. heat flows from high temperature reservoir to low temperature reservoir

C. heat flows from high temperature cycle to low temperature cycle

D. heat flows from low temperature cycle to high temperature cycle

Ans. A

Sol. the Carnot refrigeration cycle undergoes a process where heat Q_L is absorbed from the low-temperature reservoir (T_L=constant) and heat Q_H is rejected to a high-temperature reservoir (T_H=constant)

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