gradeup

SSC JE 2019-20

Mechanical Engineering

Mini Mock Challenge
(July 29- July 30 2020)

Questions & Solutions

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

   Rooster : Hen

   A. Stallion : Mare

   B. Animal : Dog

   C. Girl : Aunt

   D. Apple : Fruit

Ans. A

Sol. Rooster(Masculine) : Hen(Feminine)

   Similarly, Stallion(Masculine) : Mare(Feminine).

   Hence, the correct answer is option A.

2. **In the following question, select the odd letter/letters from the given alternatives.**

   A. HS   B. KP

   C. GR   D. BY

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

   pattern follows here:

   H + S = 27

   K + P = 27

   G + R = 25

   B + Y = 27

   Hence, the correct option is C.

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

   1) Molecule

   2) Mosquito

   3) Mixtures

   4) Mitigate

   5) Moderate

   A. 43521   B. 34512

   C. 43512   D. 35421

Ans. C

Sol. As per the dictionary order, the arrangement will be:

4. Mitigate

3. Mixtures

5. Moderate

1. Molecule

2. Mosquito

Thus the correct sequence is 43512.

Hence, option C is correct.

4. In a code language **APPLE** is written as **EGGCI**. How will **NOTEBOOK** be written as in that language?

A. EFBFCFEK
B. EFBFCEFB

C. EFBICFFB
D. EFBIFFFB

Ans. D

Sol. **Here the logic is :** +4 is added to the alphabets having single digit place value, and the sum of the digits is considered in case of alphabets having two digits place value.

(1)A → (1+4) = 5 = Which is the place value of E.

(16)P → (1+6) = 7 = Which is the place value of G.

(16)P → (1+6) = 7 = Which is the place value of G.

(12)L → (1+2) = 3 = Which is the place value C.

(5)E → (5+4) = 9 = Which is the place value of I.

Similarly, NOTEBOOK is coded as EFBIFFFB.

Hence, option D is the correct answer.

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

55, 49, 45, 43, ?, 45

A. 43
B. 55

C. 41
D. 49

Ans. A

Sol. Given series follows the pattern given below:

$9*6+1^2=55$

$9*5+2^2=49$

$9*4+3^2=45$

$9*3+4^2=43$

$9*2+5^2=43$

$9*1+6^2=45$

Hence, the correct answer is option A.

6. Peter walked 8 kms west and turned right and walked 3 kms. The again he turned right and walked 12 kms. How far is he from the starting point?

A. 7   B. 8

C. 4   D. 5

Ans. D

Sol.

A is the starting point and we need to find AE

AE= $\sqrt{(AD^2 + DE^2)} = \sqrt{(3^2 + 4^2)}$

$\sqrt{(9+16)} = \sqrt{25} = 5$

Hence, option D is the right answer.

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

7	9	6
4	5	7
2	3	?
9	11	9

A. 4   B. 5

C. 7   D. 8

Ans. A

Sol. In every column, we get the fourth number by adding first and second number and then subtracting the result from the third number.

1st Column: $(7 + 4) - 2 = 9$

2nd Column: $(9 + 5) - 3 = 11$

3rd Column: $(6 + 7) - ? = 9$

$\Rightarrow ? = 4$

Hence, option A is the correct answer.

8. **From the given alternatives, select the word which cannot be formed using the letters of the given word?**

    EMBOSSMENT

    A. BOSS
    B. TOMB

    C. STEM
    D. MATS

Ans. D

Sol. There is no "A" letter in the word "EMBOSSMENT". Hence, the word "MATS" cannot be formed using the letters of the given word.

    Hence, option D is the correct answer.

9. **In a certain code language, '+' represents 'x', '-' represents '+', 'x' represents '÷' and '÷' represents '-'. What is the answer to the following question?**

    50 + 3 ÷ 125 x 5 - 25 = ?

    A. 31
    B. 17

    C. 150
    D. 55

Ans. C

Sol. Using the proper symbols, we get

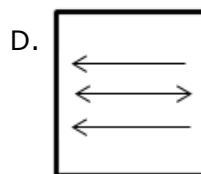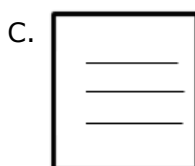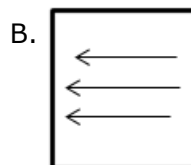   50 × 3 − 125 ÷ 5 + 25

    Now applying BODMAS rule,

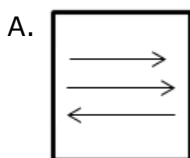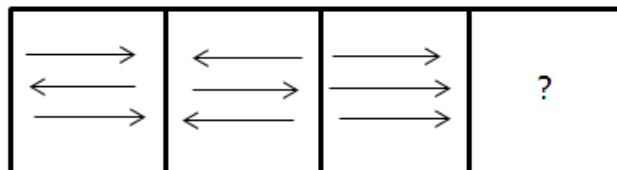   50 × 3 − 125 ÷ 5 + 25

    = 150 − 25 + 25

    = 150

    Hence, option C is the correct answer.
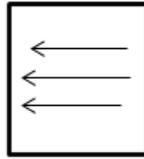
10. **Select the figure that will come next in the following figure series.**

A.

B.

C.

D.

Ans. B

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

Logic- 2nd figure is the mirror image of 1st figure, similarly, 4th figure is the mirror image of 3rd figure.

Hence, the correct answer is option B.

11. Which of the following newspapers was edited by Dadabhai Naoroji?

A. Samvad Kaumudi   B. Shom Prakash

C. Rast Goftar   D. Mahratta

Ans. C

Sol. ● **Rast Goftar newspaper was edited by Dadabhai Naoroji**.

● It was an **Anglo-Gujarati paper** operating in Bombay that was **started in 1854**.

● He is also known as the **"Grand Old Man of India"** and **"Unofficial Ambassador of India"**.

12. Age of Consent Act, 1891 was brought about by efforts of which of the following leader?

A. Dadabhai Naroji   B. Behramji Malabari

C. Bhikaji Cama   D. Pherozshah Mehta

Ans. B

Sol. • Age of Consent Act, 1891 was brought about by efforts of Behramji Malabari.

• In 1885 a girl named Rukhmabai was ordered to return to husbands home or to be jailed, Malabari popularise this case though editorials and showed the dark side of social life of female and this led to passing of Age of Consent Act, 1891.

• This act rose the age of consent for sexual intercourse for all female from ten to twelve and its violation would be considered as rape.

• Behramji Malabari also edited the 'Indian Spectator' for a long period. He also wrote collection of poems named 'The Indian Muse in English Garb'.

13. Veld grasslands are located in which of the following country?

A. New Zealand   B. Australia

C. South Africa   D. USA

Ans. C

Sol. Veld grasslands are found in South Africa.

• Veld grasslands come under Temperate Grasslands.

• Temperate grasslands are found in the regions with temperate and semi arid to semi humid climates.

• Temperate grasslands have hot summers and cold winters and here rainfall is moderate.

• Other temperate grasslands- The Puszta of Hungary, The Pampas of Argentina and Uruguay, The Steppes of the former Soviet Union.

14. Which of the following is/are the session/sessions of our Parliament?

A. Monsoon Session
B. Winter Session
C. Budget Session
D. All of these

Ans. D

Sol. ● Monsoon Session, Winter Session and Budget Session are the sessions of our Parliament.

● Budget Session is from Jan-Feb to May.

● Monsoon Session is from July to Aug-Sep.

● Winter Session is from November to December.

15. Dinesh Goswami committee is related to which of the following?

A. Parliamentary proceedings
B. Electoral reforms
C. Inter State disputes
D. Labour Reforms

Ans. B

Sol. Dinesh Goswami committee was related to **Electoral reforms**.

* The major recommendations were as follows:

a) Time limit for bye-elections.

b) Increase in deposits from independents.

c) A check on advertisements on new papers and strengthening of the election commission.

16. Who is known as the father of Internet?

A. Robert E. Kahn
B. Tim Berners-Lee
C. Larry page
D. Vint Cerf

Ans. D

Sol. • **Vint Cerf** is known as a "**Father of the Internet**".

• He is the co-designer of the **Transmission Control Protocol and Internet Protocol**, or TCP/IP.

• He is known as architecture of the Internet.

• He has served as vice president and chief Internet evangelist for Google.

• Tim Berners-Lee invented the **World Wide Web**.

17. What is phase relationship between displacement and velocity in SHM?

A. Velocity leads displacement by 90°

B. Velocity lacks displacement by 90°

C. Velocity leads displacement by 180°

D. Velocity lacks displacement by 180°

Ans. A

Sol. • Velocity leads displacement by 90°.

• **Simple harmonic motion** is a periodic motion or oscillation where the restoring force is directly proportional to the displacement and acts in the direction opposite to that of displacement.

18. World Soil day is celebrated on?

A. 6th April   B. 7th August

C. 1st October   D. 5th December

Ans. D

Sol. * World Soil day is celebrated on **5th December**.

* The Soil day is recognised on 5th December by **Food and Agriculture Organisation of UN.**

* The main aim is to communicate message on importance of soil quality for food security, healthy Ecosystem and human well being.

* Theme of 2019 soil day was '**Stop Soil Erosion, Save Our Future'**.

* Sustainable Development Goals 2, 3, 12 and 15 are related to soil conservation and soil utilisation.

19. Which Indian state won the 'World Habitat Award'?

A. Jharkhand   B. Odisha

C. Tamil Nadu   D. Maharashtra

Ans. B

Sol. • **Odisha** was awarded the '**World Habitat Award'**.

• Odisha was awarded the 'World Habitat Award' for **Jaga Mission.**

• The award was given by the World Habitat, a UK based organization.

• Jaga Mission is a slum transforming into liveable habitats mission.

• **Jaga Mission** is also known as Odisha Liveable Habitat Mission.

20. Who among the following has assumed charge as Punjab's first woman chief secretary on 26th June 2020?

A. Vini Mahajan   B. Mugdha Sinha

C. Smita Sabharwal   D. Punita Arora

Ans. A

Sol. * **Senior IAS officer Vini Mahajan** assumed charge as Punjab's first woman chief secretary on 26th June 2020.

* She has replaced **Karan Avtar Singh**.

* She has become the **first Woman Chief Secretary of Punjab**.

* She is a **1987-batch IAS officer.**

21. The term N.T.P. stand for:

    A. Norminal Temperature and Pressure

    B. Natural temperature and Pressure

    C. Normal Temperature and Pressure

    D. Normal Thermodynamic Practice

Ans. C

Sol. N.T.P stands for Normal temperature and Pressure

22. Rankine's theory is valid to_____.

    A. long column   B. short column

    C. both   D. none of these

Ans. C

Sol. Rankine theory is applicable for both long and short column.

23. A counter flow heat exchanger is used to heat water from 20 °C to 80 °C by using hot exhaust gas entering at 140 °C and leaving at 80 °C. The log mean temperature difference for the heat exchanger is

    A. 80 °C

    B. 60 °C

    C. 110 °C

    D. Not determinable as Zero/Zero is involved.

Ans. B

Sol. In cases where the numerator and denominator of LMTÐ expression are equal to zero, LMTD=temperature difference at any end which in this case is either 140— 80 or 80—20= 60· C.
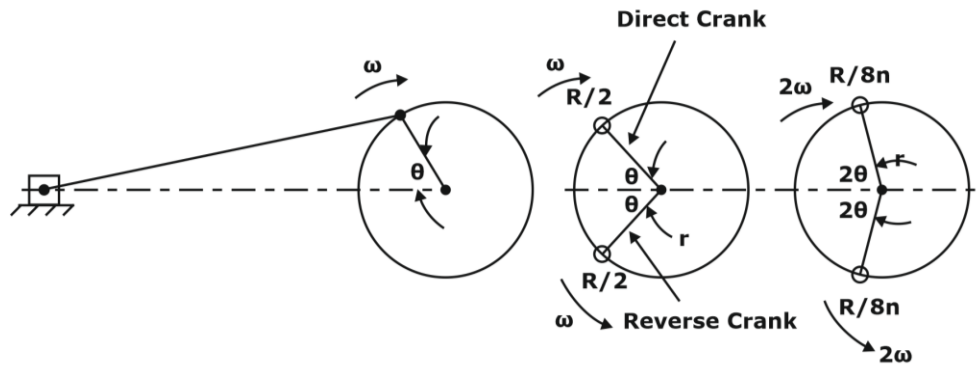
24. For a refrigeration system If T_1 and T_2 are the limiting temperature and W is the work done on the system, then heat extracted from refrigeration Space is

    A. W   B. $\dfrac{T_1 - T_2}{T_1} W$

    C. $\dfrac{T_1 - T_2}{T_2} W$ D. $\dfrac{T_2 W}{T_1 - T_2}$

Ans. D

Sol. $C.O.p. = \dfrac{Q_2}{W} = \dfrac{T_2}{T_1 - T_2}$

$\therefore Q_2 = \dfrac{T_2}{T_1 - T_2} W$

25. What is the critical pressure ratio for isentropic nozzle flow with ratio of specific heats as 1.5?

A. $(0.8)^3$ B. $(0.8)^{0.6}$

C. $(1.25)^{0.33}$ D. $(1.25)^3$

Ans. A

Sol. Critical pressure ratio $= \left(\dfrac{2}{n+1}\right)^{\frac{n}{n-1}}$,

Where , n=1.5

∴ Critical pressure ratio $= \left(\dfrac{2}{1.5+1}\right)^{\frac{1.5}{0.5}} = (0.8)^3$

26. The Bernoulli's equation refers to conservation of

A. Mass   B. Momentum

C. Force   D. Energy

Ans. D

Sol. Bernoulli's equation refers to conservation of energy.

27. The ratio of average speed to the average velocity

A. Less than 1   B. Equal to 1

C. Greater than 1   D. Greater than equal to 1

Ans. D

Sol. Avg speed $= \dfrac{\text{Total distance}}{\text{Total time}}$ and avg. velocity $= \dfrac{\text{Total displacement}}{\text{Total time}}$

⇒ Avg. speed ≥ Avg. velocity

28. Friction between chip an tool can be reduced by

A. increasing rake angle   B. increasing shear angle

C. increasing depth of cut   D. increasing sliding velocity

Ans. D

Sol. The friction between tool and chip can be reduced by increasing the cutting speed.

29. The principle of direct and reverse cranks is readily applicable to _____.

A. primary balance   B. secondary balance

C. balancing of in-line engines   D. partial primary balance

Ans. C

Sol. The direct and reverse crank balancing method (also known as contra-rotating mass balancing) aren't separate methods but rather one way of modelling the inertial effects of a reciprocating mass, such as a cylinder in an engine, as two separate masses rotating in opposite directions.

30. Kelvin-plank law deals with

A. Conservation of Energy   B. Conservation of heat

C. Conservation of mass   D. Conservation of heat into work

Ans. D

Sol. Kelvin – Plank gives the concept of heat engine hence, it is conversion of heat into work.

31. Which one of the following properties cannot be evaluated by static tension test?

A. Shear Strength   B. Modulus of elasticity

C. Ductility   D. Poisson's ratio

Ans. A

Sol. Shear strength property cannot be evaluated by static tension test.

32. The thickness of boundary layer for a laminar flow and turbulent flow is given by

A. $\delta_{laminar} = \dfrac{5x}{\sqrt{Re_x}}$ and $\delta_{turbulent} = \dfrac{0.38x}{\left(Re_x\right)^{1/6}}$

B. $\delta_{laminar} = \dfrac{5x}{\left(Re_x\right)^{1/3}}$ and $\delta_{turbulent} = \dfrac{0.38x}{\left(Re_x\right)^{1/5}}$

C. $\delta_{laminar} = \dfrac{5x}{\left(Re_x\right)^{1/2}}$ and $\delta_{turbulent} = \dfrac{0.38x}{\left(Re_x\right)^{1/5}}$

D. $\delta_{laminar} = \dfrac{3.91x}{\left(Re_x\right)^{1/2}}$ and $\delta_{turbulent} = \dfrac{0.38x}{\left(Re_x\right)^{1/6}}$

Ans. C

Sol. The correct option is (c).

$\delta_{laminar} = \dfrac{5x}{\left(Re_x\right)^{1/2}}$ and $\delta_{turbulent} = \dfrac{0.38x}{\left(Re_x\right)^{1/5}}$

33. In machining operation chip thickness ratio is 0.3 back rake angle of tool is 10°. What is the value of shear strain ?

A. 2.24   B. 0.86

C. 3.1   D. 3.34

Ans. D

Sol. Shear strain $V = \cot\phi + \tan(\phi - \propto)$

We know

$$\tan\phi = \frac{\cos\propto}{\dfrac{t_2}{t_1} - \sin\propto} = \frac{\cos 10°}{\dfrac{1}{0.3} - \sin 10°}$$

$\phi = 17.31°$

Shear strain = cot 17.31 + tan (17.31 – 10) = 3.34

34. The draught in locomotive boilers is produced by

    A. Chimney   B. Centrifugal fan
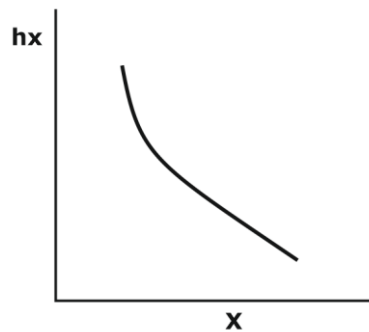
    C. Steam jet   D. Locomotion

Ans. C

Sol. In induced draught system, jet of steam is placed at the bottom of the chimney. It sucks in air and forces it into the chimney.

35. In laminar flow over a flat plate, the convective heat transfer coefficient is proportional to (x is the distance from the leading edge)

    A. $x^{1/2}$ B. $x^{-1/2}$

    C. $x^{1/3}$ D. $x^{-1/5}$

Ans. B

Sol. Option 2 is the correct answer.

36. Gibb's free energy functions is a property Comprises.

    A. pressure, volume and temperature   B. enthalpy, temperature and entropy

    C. temperature, pressure and enthalpy   D. volume, enthalpy and entropy

Ans. B

Sol. Gibb's free energy function (G)

G = H – TS

G = f(H, T, S)

37. The permissible stress in a filled weld is 100 N/mm². The fillet weld has equal leg lengths of 15 mm each. The allowable shearing load on weldment per cm length of the weld is

    A. 22.5 kN   B. 15.0 kN

    C. 10.6kN   D. 7.5kN

Ans. C

Sol. l=1 cm =10 mm

For single fillet weld

P=0.707 x t x l x permissible stress

P=0.707 x 15 x 10 x 100

=10.6 kN

38. Geometric similarity between Model and prototype means the similarity of

A. Motion

B. Discharge

C. Linear dimensions

D. Forces

Ans. C

Sol. Geometric similarity $\Rightarrow$ Similarly in linear dimensions

39. A reversed Carnot cycle working as a heat pump has a COP of 7. What is the ratio of minimum to maximum absolute temperatures?

A. $\dfrac{7}{8}$
B. $\dfrac{1}{6}$

C. $\dfrac{6}{7}$
D. $\dfrac{1}{7}$

Ans. C

Sol. $(C.O.P.)_{H.P.} = \dfrac{T_1}{T_1 - T_2} = 7$

$\Rightarrow T_1 = 7T_1 - 7T_2$

$\Rightarrow 6T_1 = 7T_2$

$\Rightarrow \dfrac{T_2}{T_1} = \dfrac{6}{7}$

40. A body is loaded as shown in the figure below. If the maximum shear stress that the material can take is 180MPa, find the stress 'σ'.
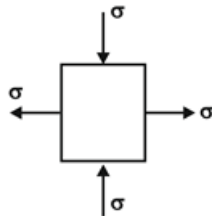
A. 120MPa
B. 150MPa

C. 200MPa
D. 180MPa

Ans. D

Sol. Given,

$\sigma_x = \sigma_1 = \sigma$, $\sigma_y = \sigma_2 = -\sigma$, $\tau_{xy} = 0$

$\tau_{max} = 180\,MPa$

Using maximum shear stress theory or Guest Tresca Theory

$\sigma_1 = \sigma$, $\sigma_2 = -\sigma$

$$\tau_{max} = Max \left| \frac{\sigma_1 - \sigma_2}{2}, \frac{\sigma_1}{2}, \frac{\sigma_2}{2} \right|$$

$$\tau_{max} = Max \left| \frac{\sigma - (-\sigma)}{2}, \frac{\sigma}{2}, \frac{-\sigma}{2} \right|$$

$\tau_{max} = \sigma$

$\sigma = 180\ MPa$

41. German silver is an alloy of

A. Cu, Zn, and Ni

B. Cu, V and Mo

C. Zn, Ni and V

D. Mo and Ni

Ans. A

Sol. German silver contains approximately 60% Cu, 20% Ni and 20% Zn. It is used because of its hardness and resistance to corrosion.

42. The Heat transfer Q, The work done W and the change in internal energy U are all zero in the case of

A. a rigid vessel containing steam at 150 °C left in the atmosphere which is at 25 °C

B. 1 Kg of gas contained in an insulated cylinder expanding as the piston moves slowly outwards

C. a rigid vessel containing ammonia gas connected through a valve to an evacuated rigid vessel. both Vessel, valve and connecting pipes being well insulated. After opening valve, Condition inside the two vessel becoming uniform.

D. 1 kg of air flowing adiabatically. from the atmosphere into a previously evacuated bottle.

Ans. C

Sol. This is the case of free expansion in evacuated vessel

$\therefore$ dQ=0 and dw = 0

$\therefore$ From 1st Law of thermodynamics

dQ=dU+dW

$\Rightarrow$ 0=dU+0

$\Rightarrow$ du = 0

43. Which of the following is soderberg's equation

Here σ_a = stress amplitude

σ_m = mean stress

σ_{ut} = ultimate stress

σ_e = endurance stress

σ_y = yield stress

F = factor of safety

A. $\dfrac{\sigma_a}{\sigma_e} + \dfrac{\sigma_m}{\sigma_y} = \dfrac{1}{F}$

B. $\dfrac{\sigma_a}{\sigma_e} + \dfrac{\sigma_m}{\sigma_{ut}} = \dfrac{1}{F}$

C. $F\dfrac{\sigma_a}{\sigma_e} + \left(F\dfrac{\sigma_m}{\sigma_{ut}}\right)^2 = 1$

D. All of the above

Ans. A

Sol. $\dfrac{\sigma_a}{\sigma_e} + \dfrac{\sigma_m}{\sigma_y} = \dfrac{1}{F} \Leftarrow$ soderberg's equation

44. The pressure gradient for free vortex motion in radial direction with radius of curve (r)

A. Proportional to $\dfrac{1}{r^3}$

B. Proportional to $\dfrac{1}{r^2}$

C. Proportional to $\dfrac{1}{r}$

D. Proportional to r

Ans. A

Sol. The pressure gradient, $\dfrac{\partial P}{\partial r} = \dfrac{\rho v^2}{r}$

For free vortex flow, Vr =Constant =C

$\dfrac{\partial P}{\partial r} = \dfrac{\rho C^2}{r^3}$ i.e., Varies as $\dfrac{1}{r^3}$

45. Which gas power cycle consists of four processes during which work alone is transferred during two processes and heat alone is transferred during the other two processes?

A. Atkinson cycle

B. Carnot cycle

C. Diesel cycle

D. Otto cycle

Ans. D

Sol. For an Otto cycle consisting of two constant volume heat addition and heat rejection process and two reversible adiabatic compression and expansion.

During constant volume process, heat addition and heat rejection taken place and no work is transferred.

During adiabatic processes [compression expansion] only work transfer taken place but no heat transfer occurs.

46. Which of the following metal is best suitable for extrusion either hot or cold ?
    A. Zinc   B. Magnesium
    C. Copper   D. Aluminum

Ans. D

Sol. Aluminium products are very popular for extrusion. The typical product made are railing for sliding doors; tubing for various cross-sections, structural and architectural shapes and doors and window frames.

Other than mention options, Al is most appropriate.

47. For a governor running at constant speed, what is the value of the force acting on the sleeve.
    A. Zero   B. Variable depending upon the load
    C. Maximum   D. Minimum

Ans. A

Sol. When governor is running at constant speed, then the net force acting of sleeve is zero.

48. A dimensionless quantity that connects the link between velocity flow field and the temperature field is
    A. Nusselt number   B. Prandlt number
    C. Reynolds number   D. Grashof number

Ans. B

Sol. Prandlt number $(P_r) = \dfrac{\mu C_p}{k} = \dfrac{V}{\alpha}$

$P_r = \dfrac{\text{Molecular momentum diffusivity}}{\text{Thermal diffusivity}}$

Hence prandial number gives the link between velocity flow field and temperature field.

49. Production cost refers to prime cost plus
    A. factory overheads
    B. factory and administration overheads
    C. factory administration and sales overheads
    D. factory, administration and sales overheads and Profit

Ans. A

Sol. Production Cost= Prime Cost + Factory overhead

Factory overhead= Direct material cost + Direct labour cost + (Variable) direct expenses

50. If ∫Pdv and –∫Vdp for a thermodynamic system of an ideal gas on evaluation give the same quantity during a process, then the process under gone by the system is.
    A. Insenthalpic   B. Isentropic
    C. Isobaric   D. Isothermal

Ans. D

Sol. For isothermal process

PV = Constant

Pdv + Vdp = 0

Pdv = - Vdp

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