



SSC JE 2019-20

Mechanical Engineering

Mini Mock Challenge

(August 08- August 09 2020)

Questions &
Solutions

1. Name the first woman chief minister of Jammu and Kashmir?

- A. Sarkina Itoo
- B. Mehbooba Mufti
- C. Asiya Naqash
- D. Hina shafi bhat

Ans. B

Sol. Mehbooba mufti on 4 April 2016 made history as she took oath as the first woman chief minister of jammu and Kashmir, the only muslim majority state of India she is the daughter of late mufti mohammad syed and the president of ruling people's democratic party.

2. Which article of the Indian Constitution for all citizen in public employment ?

- A. Article-22
- B. Article-16
- C. Article-20
- D. Article-25

Ans. B

Sol. Article 16 of the Indian Constitution deals with equality of opportunity in matters of public employment. It states that no citizen shall, on grounds only of religion, race, caste, sex, descent, place of birth, residence or any of them, be ineligible for, or discriminated against in respect or, any employment or office under the state. Equal Employment Opportunity (EEO) principles apply to:

- Access to jobs
- Conditions of employment
- Relationships in the workplace
- The evaluation of performance and
- The opportunity for training and career development.

Hence option B is the right answer.

3. Who is the first women cricketer to receive CK Nayudu lifetime achievement Award?

- A. Mithali Raj
- B. Jhulan Goswami
- C. Shantha Rangaswamy
- D. Harmanpreet Kaur

Ans. C

Sol. Shantha Rangaswamy is the first women cricketer to receive CK Nayudu lifetime achievement Award. She is the former captain of Indian Women Cricket Team.

4. Buffer stock operations are conducted by

- A. Warehousing Corporation of India
- B. State Trading Corporation of India
- C. Food Corporation of India
- D. Ministry of Agriculture

Ans. C

Sol.

- Buffer stock operations are conducted by Food Corporation of India.
- It is an attempt to use commodity-storage for the purposes of stabilising prices in an entire economy.

5. 'Strikeout' is associated with which sports?
- A. Cricket
B. Snooker
C. Baseball
D. Tennis

Ans. C

Sol. Strikeout is a term associated with the sport baseball. In baseball or softball, a strikeout (or strike-out) occurs when a batter racks up three strikes during a time at bat. It usually means the batter is out.

6. Atomic Number is denoted by which alphabet?
- A. A
B. N
C. Z
D. E

Ans. C

Sol. Atomic number is denoted by Z while atomic weight is denoted by A. Hence, Option C is the correct answer.

7. Buccal cavity is a component of which organ system?
- A. Digestive system
B. Respiratory system
C. Circulatory system
D. Reproductive system

Ans. A

Sol. Buccal cavity is a component of Digestive system. Digestion is one of the process of nutrition. The digestive system has six components which are mouth, esophagus, stomach, small intestines, colon, rectum etc.

Hence, Option A is the correct answer.

8. 'Faster, Higher, Stronger' is motto for which of the following Games Event?
- A. Asian Games
B. IPL
C. Olympics
D. FIFA World Cup

Ans. C

Sol. 'Faster, Higher, Stronger' is motto for the Olympics games.

The motto of IPL games is 'Yatra Pratibha Avsara Prapnotihi'. It is in Sanskrit which means 'where talent meets opportunity'.

The motto of FIFA is 'For the game, For the world'.

Hence, option C is the correct answer.

9. Who authored the book 'Modi's Midas Touch in Foreign Policy'?
- A. Surendra Kumar
B. Sunita Narayan
C. P.S. Negi
D. Anuj Dhar

Ans. A

Sol. Surendra Kumar is the author of the book 'Modi's Midas Touch in Foreign Policy'. This book outlines the progress of India's Foreign Policy by the Prime Minister Narendra Modi in the last two and a half years. It includes different policy initiatives focusing on the vision of developing India into a strong economically developed nation.

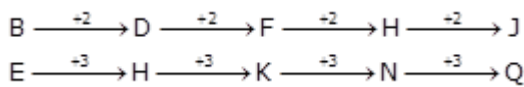
10. Which Article of the Indian constitution provides free and compulsory education to children?
- | | |
|-----------------|---------------|
| A. Article 21-A | B. Article 46 |
| C. Article 39 | D. Article 15 |

Ans. A
Sol.

- According to **Article 21A** of Indian Constitution, the State shall provide free and compulsory education to all children of the age of six to fourteen years in such manner as the State may, by law, determine.
- This article was inserted in the constitution by 86th Amendment Act, 2002, also known as Right of Children to Free and Compulsory Education Act.

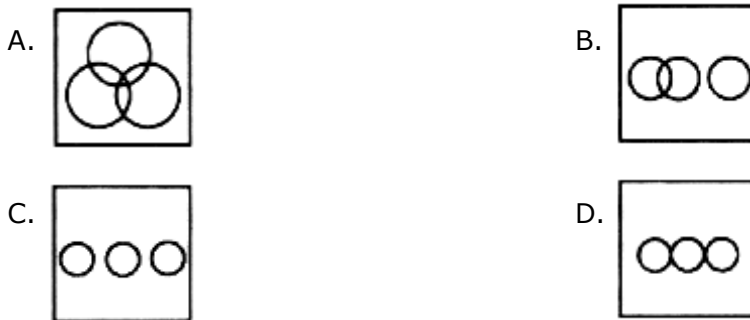
11. A series is given with one term missing. Select the correct alternative from the given ones that will complete the series.
- BE, DH, ? , HN, JQ
- | | |
|-------|-------|
| A. FI | B. FK |
| C. GI | D. GK |

Ans. B
Sol.



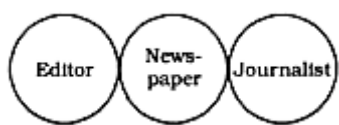
Hence, option B is the right answer.

12. Which figure best represents the relationship between Editor, Newspaper and Journalist?



Ans. D

Sol. Editor is different from Journalist. Similarly, News paper is different from both the Editor and Journalist. But, all the three inter-related in some manner.



Hence, option D is correct answer.

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

Plane : Hangar :: Car : ?

- A. Road
- B. Garage
- C. Tyre
- D. Brake

Ans. B

Sol. Plane is temporarily parked in the Hangar.

Similarly, car is parked in the garage.

Hence, option B is the correct response.

14. If 'FIRST' is written as 'HKTUV', how will 'SECOND' be written as?

- A. UGEMPF
- B. UHEQPF
- C. UGEQSF
- D. UGEQPF

Ans. D

Sol. As, FIRST is coded as,

F + 2 → H

I + 2 → K

R + 2 → T

S + 2 → U

T + 2 → V

Similarly,

SECOND will be coded as,

S + 2 → U

E + 2 → G

C + 2 → E

O + 2 → Q

N + 2 → P

D + 2 → F

Hence, option D is the correct response.

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

127, 63, 31, 15, 7, ?

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

Ans. B

Sol. **127** - 1 = 126; 126 ÷ 2 = **63**,

63 - 1 = 62; 62 ÷ 2 = **31**,

31 - 1 = 30; 30 ÷ 2 = **15**,

15 - 1 = 14; 14 ÷ 2 = **7**,

7 - 1 = 6; 6 ÷ 2 = **3**

Thus the next number in the series will be '3'.

Hence, the correct option is B.

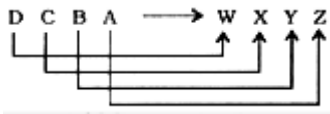
16. In the following question, select the related group of letters from the given alternatives.

DCBA: WXYZ:: IJKL:?

- A. RQPO
- B. QPON
- C. PONM
- D. SRQP

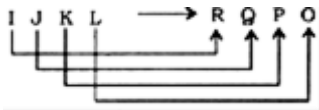
Ans. A

Sol. with reference to the position of the alphabets,



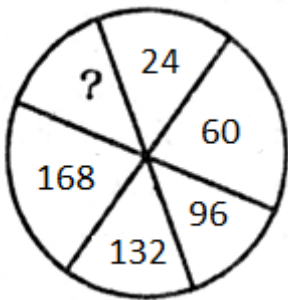
Pairs of Opposite Letters.

Similarly,



Hence, option A is the right answer.

17. In each of the following questions, select the missing number front the given responses.



- A. 330
- B. 204
- C. 428
- D. 216

Ans. B

Sol. $24 + 36 = 60$
 $60 + 36 = 96$
 $96 + 36 = 132$
 $132 + 36 = 168$
 $168 + 36 = 204$

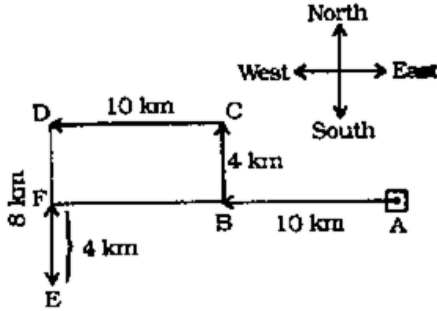
Hence, option B is the correct answer.

18. A man goes 10 km westward, then turns right and proceeds 4 km, then travels 10 km towards left, then travels 8 km towards left and finally goes 4 km Northward . Calculate his distance from his initial place in the horizontal direction.

- A. 20 km
- B. 22 km
- C. 23 km
- D. 25 km

Ans. A

Sol.



Required distance
= AF = AB + BF
= (10 + 10) km. = 20 km.

19. Babita is Ajay's wife and Chiranjiv is Divya's father. If Ajay's mother-in-law is wife of Divya's grandfather, then how is Babita related to Chiranjiv's wife?
- A. Sister-in-law
 - B. Sister
 - C. Cousin
 - D. Nephew

Ans. A

Sol. Babita is the wife of Ajay.

Chiranjiv is father of Divya.

Wife of Divya's grandfather means grandmother of Divya.

Grandmother of Divya is mother-in-law of Ajay.

Therefore, Babita is daughter of Divya's grandmother.

Chiranjiv is brother of Babita.

Therefore, Babita is sister-in law of Chiranjiv's wife.

Hence, option A is the right answer.

20. In the following question, two statements are given each followed by two conclusions I and II. You have to consider the statements to be true even if they seem to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follows from the given statements.

Statements:

All radios are electric goods.

All table lamps are electric goods.

Conclusions:

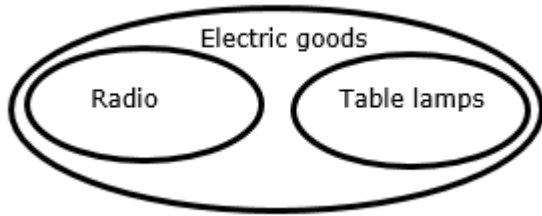
I. Some radios are table lamps.

II. Some table-lamps are radios.

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

Ans. C

Sol. The least possible Venn diagram for the given statements is,



Conclusions:

- I. Some radios are table lamps - False, it is not a definite case.
- II. Some table-lamps are radios - False, it is not a definite case.

Thus neither conclusion I nor II follows.

Hence, option C is the correct response.

21. For a material to incompressible its Poisson’s ratio should be.
- A. infinite
 - B. one
 - C. zero
 - D. None of these

Ans. D

Sol. For a material to be incompressible bulk modulus should be infinite.

$$\text{Compressibility} = \frac{1}{\text{bulk Modulus}}$$

$k \rightarrow \infty$, (if compressibility = 0)

Compressibility is defined as the ability to reduce volume under hydrostatic compression. Or it will come as a function of the bulk modulus. From the strength of materials equations, you can see that when Poisson’s ratio is 0.5, bulk modulus will go to infinity (or to a high value if it is close to 0.5).

22. A 4-stroke diesel engine, when running at 2000 rpm has fuel injection duration of 1.5 milli second. What is the corresponding duration of the crank angle in degrees?
- A. 18°
 - B. 9°
 - C. 36°
 - D. 15°

Ans. A

Sol. given , N = 2000 rpm

fuel injection time = 1.5 milli second

total rotation in 60 second = 2000

revolution in 1 sec = 2000/60

$$\text{revolution in 1.5 milli second} = \frac{2000}{60} \times 1.5 \times 10^{-3} = 0.05 \text{ rev}$$

1 revolution = 360°

so total angle turned in .05 revolution = 0.05×360° = 18°

23. In arc welding, arc is created between the electrode and work by
- A. flow of current
 - B. voltage
 - C. material thickness
 - D. contact resistance

Ans. D

Sol. This phenomenon is said to be a result of a thermal **contact resistance** existing between the contacting surfaces. Thermal **contact resistance** is defined as the ratio between this temperature drop and the average **heat** flow across the interface. Ans is D.

24. In order to ram the sand softer on the pattern face and harder at the back of the mould, which of the following types of moulding machines is used?
- A. Jolt
 - B. Sand slinger
 - C. Squeezing
 - D. Stripper plate

Ans. A

Sol. In order to ram the sand softer on the pattern face and harder at the back of the mould, jolting is used.

25. The transformation in which one liquid phase and one solid phase transforms into a solid phase is
- A. Peritectic
 - B. Eutectic
 - C. Eutectoid
 - D. None of the above

Ans. A

Sol. In iron carbon diagram, peritectic transformation takes place at 1492° and 0.18% of carbon.

26. The enthalpy of saturated water at triple point in a steam table is
- A. zero
 - B. slightly negative
 - C. slightly positive
 - D. can't say

Ans. C

Sol. In steam table, the internal energy and entropy of saturated water at triple point (0.01°C) are chosen to be zero.

Enthalpy, $h = u + pv$

Due to "pv" terms, the enthalpy of saturated water at triple point will be slightly positive.

27. What is the effect of decrease of reheat pressure on the quality of steam at turbine exhaust?
- A. decreases
 - B. increases
 - C. remains same
 - D. none of the mentioned

Ans. B

Sol. For too low a reheat pressure, the exhaust steam may even be in the superheated state which isn't good.

28. The Bulk modulus of elasticity of a fluid is defined as

A. $-\frac{dV/V}{dp}$

B. $-\frac{dp}{dV/V}$

C. $\frac{dp}{dV}$

D. $\sqrt{\frac{dp}{d\rho}}$

Ans. B

Sol. Bulk modulus of elasticity (k)

$$k = \frac{dp}{-\frac{dV}{V}}$$

$$\Rightarrow k = -V \frac{dp}{dV}$$

29. Work done in a free expansion process is:

A. Positive

B. Negative

C. Zero

D. Maximum

Ans. C

Sol. $W = \int PdV$

as $P=0$ (external pressure for free expansion)

$W=0$

30. For two infinite parallel gray planes with emissivities $\epsilon_1 = \epsilon_2 = 0.5$, the net interchange view factor is

A. 0.4

B. 1

C. 0.6

D. 3

Ans. B

Sol. For two infinite parallel plane the View factor $F_{12}=F_{21}=1$

View factor is geometric property, does not depend upon emissivity.

31. Following assumptions are made in the derivation of Bernoulli's equation of motion of the streamline

1) Flow is laminar

2) Flow is irrotational

3) Flow is rotational

4) Flow is inviscid

5) Flow is steady and incompressible or compressible

A. 1, 2, 4

B. 1, 3, 4, 5

C. 1, 3, 5

D. 1, 2, 4, 5

Ans. D

Sol. **Assumptions of Bernoulli equation:**

- (1). Along a Streamline - Bernoulli's equation can only be used along a streamline i.e. only between points on the same streamline.
- (2). Inviscid flow - Energy loss due to viscous effects is small.
- (3). Steady State - The velocity of the flow (V_{Fluid}) is not a function of time.
- (4). Incompressible and irrotational fluid.

32. Production planning consists of

- A. Preplanning and routing
- B. scheduling and dispatching
- C. Expediting
- D. all of these

Ans. D

Sol. It can comprise the following activities:

- Determination of the required product mix and factory load to satisfy customers' needs.
- Matching the required level of production to the existing resources.
- Scheduling and choosing the actual work to be started in the manufacturing facility.
- Setting up and delivering production orders to production facilities.

33. The value of Reynolds number for a fluid flowing over a flat plate is 15625 at a distance of 15 cm from the leading edge. The thickness of the boundary layer is

- A. 4 mm
- B. 5 mm
- C. 0.6 mm
- D. 6 mm

Ans. D

Sol. Here the value of Reynolds number is less than 5×10^5 . So this will be a case of laminar boundary layer.

The boundary layer thickness for laminar flow is given by $\frac{5x}{(Re_x)^{1/2}}$.

Now putting $x = 15$ cm and $Re_x = 15625$, we will get $\delta_{\text{laminar}} = 0.6$ cm = 6 mm.

So, the correct option is (d).

34. Consider a cyclic process in which different states have heat interaction of 8 KJ, -10 KJ and 5 KJ respectively. The change in internal energy is

- A. 3 KJ
- B. -3 KJ
- C. 23 KJ
- D. 0

Ans. D

Sol. As we know, Internal energy is a point function thus its cyclic integral is always equals to zero

Thus, for a cyclic process, change in internal energy, $dU = 0$

35. The property of a fluid which enables it to resist tensile stress is known as:

- A. Compressibility
- B. Capillary Action
- C. Cohesion
- D. Adhesion

Ans. C

Sol. The force of attraction between the molecules of a liquid by virtue of which they are bound to each other to remain as one assemblage of particles is known as the force of cohesion. This property enables the liquid to resist tensile stress.

36. A structural member subjected to an axial compressive force is called ____

- A. beam
- B. column
- C. frame
- D. strut

Ans. D

Sol. A structural member subjected to an axial compressive force is called strut.

Strut can horizontal, inclined and vertical.

A vertical Strut is called column, pillar etc. Column is also a structural member subjected to an axial compressive force but vertically.

37. It is proposed to coat 2 mm diameter wire with enamel paint $\left(K = 0.2 \frac{W}{m \cdot k} \right)$ to increase

heat transfer with air. If the air side heat transfer coefficient is $50 \frac{W}{m^2 k}$, Then what will be

the optimum thickness of enamel Paint?

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

Ans. C

Sol. Given, $k = 0.2 \frac{W}{mk}$, $h = \frac{50W}{m^2k}$,

$D = 2 \text{ mm} \rightarrow R = 1 \text{ mm}$

Critical Radius $r_o = \frac{k}{n} = \frac{0.2}{50} m = \frac{0.2}{50} k \times 1000 \text{ mm}$

$r_o = 4 \text{ mm}$

Then, optimum thickness will be $= r_o - R = 4 - 1 = 3 \text{ mm}$

38. Froude number is the ratio of inertia force to

- A. Viscous force
- B. Surface tension force
- C. Elastic force
- D. Gravity force

Ans. D

Sol. $F_r (\text{Froude Number}) = \sqrt{\frac{F_I (\text{Inertia force})}{F_g (\text{gravity force})}}$

39. Plain and butt welds may be used on materials upto approximately

- A. 25 mm thick
- B. 40 mm thick
- C. 50 mm thick
- D. 70 mm thick

Ans. A

Sol. Butt weld material thickness can't be more 25 mm.

40. If $S = 4t^2 - 2t + 2$ find acceleration at $t = 3$ sec in (m/s^2)

- A. 8
- B. 22
- C. 32
- D. 40

Ans. A

Sol. we know

$$V = \frac{ds}{dt} = 8t - 2$$

$$\text{and } a = \frac{dv}{dt} = 8 \text{ m/s}^2$$

41. What type of boiler is a Velox boiler?

- A. Forced circulation boiler
- B. Natural circulation boiler
- C. Positively forced circulation boiler
- D. Once- through boiler

Ans. A

Sol. Velox boiler is a forced circulation boiler. It has gas turbine driven air compressor, which compresses the air.

42. The center of gravity of the coupler link in a 4-bar mechanism would experience _____.

- A. No acceleration
- B. Only linear acceleration
- C. Only angular acceleration
- D. Both linear and angular accelerations

Ans. D

Sol. A four-bar linkage, also called a four-bar, is the simplest movable closed chain linkage. It consists of four bodies, called bars or links, connected in a loop by four joints. Generally, the joints are configured so the links move in parallel planes, and the assembly is called a planar four-bar linkage and in such type of linkages the body moves in both linear and angular motions so it have both kind of velocities

43. A component is to be tapered from $D = 25$ mm to $d = 15$ mm. Over a length of 7.5 cm the component rest will be swivelled through an angle of.

- A. 3.814°
- B. 1.907°
- C. 7.594°
- D. 3.797°

Ans. A

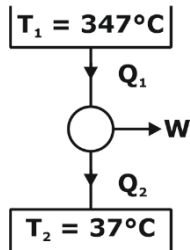
$$\text{Sol. } \theta = \tan^{-1} \left(\frac{\frac{D}{2} - \frac{d}{2}}{L} \right) = \tan^{-1} \left(\frac{(25 - 15) \text{ mm}/2}{7.5 \text{ cm}} \right)$$

$$= \tan^{-1} \left(\frac{0.5}{7.5} \right) = 3.814^\circ$$

44. A Carnot engine operates between 37°C and 347°C. If the engine produces 620 kJ of work, the entropy change (in kJ/K) of working fluid during heat addition is _____.
 A. 1
 B. 2
 C. 3
 D. 4

Ans. B

Sol.



Source Temperature (T_1) = 347°C = 347 + 273 = 620 K

Sink Temperature (T_2) = 37°C = 37 + 273 = 310 K

Work output (W) = 620 KJ

$$\text{Efficiency of Heat engine } (\eta) = 1 - \frac{T_2}{T_1} = 1 - \frac{310}{620} = 0.5$$

$$\eta = \frac{\text{Work Output}}{\text{Heat Supplied}} = \frac{W}{Q_1} = \frac{620}{Q_1} = 0.5$$

$$Q_1 = 1240 \text{ KJ}$$

Entropy change during heat addition of working fluid in heat engine (Δs) =

$$\frac{Q_1}{T_1} = \frac{1240}{620} = 2 \text{ KJIK}$$

45. Dry Bulb lines (DBT) are shown in psychrometric chart as
 A. Curved lines or exponential lines
 B. Horizontal Lines
 C. Vertically inclined to the right
 D. Vertically Straight Lines

Ans. D

Sol. Dry Bulb lines are shown vertically straight lines on the psychrometric chart.

46. The internal energy of a gas obeying vander Waals equation $\left(P + \frac{a}{v^2}\right)(v - b) = RT$ depends on its
 A. temperature
 B. temperature and pressure
 C. temperature and specific volume
 D. pressure and specific volume

Ans. C

Sol. $u = f(T, V)$

u depend on temp and specific volume for real gas.

$$\left(P + \frac{a}{v^2}\right)(v - b) = RT$$

47. The maximum magnitude of the unbalance force along the line parallel to the line of stroke is called.

- A. Hammer blow
- B. Swaying couple
- C. Variation of Tractive effort
- D. None of these

Ans. C

Sol. **Swaying couple:** The couple has the swaying effect about a vertical axis, and tends to sway the engine alternately in clockwise and anticlockwise directions. Hence the couple is known as swaying couple.

Hammer blow: The maximum magnitude of the unbalanced force along the perpendicular to the line of stroke is known as Hammer blow.

Variation of Tractive effort: The maximum magnitude of the unbalance force along the line parallel to the line of stroke is called as variation of tractive force .

48. Which of the following statement is correct regarding COP of heat pump?

- A. $COP_{\text{Heat Pump}} = 1 + COP_{\text{Refrigeration}}$
- B. $COP_{\text{Heat Pump}} = \frac{1}{\eta_{\text{Heat Engine}}}$
- C. Both A and B
- D. None of these

Ans. C

Sol. We Know

$$COP_{\text{Heat Pump}} = 1 + COP_{\text{Refrigeration}} = \frac{1}{\eta_{\text{Heat Engine}}}$$

49. An element is subjected to the following strains:

$$\epsilon_x = 800, \epsilon_y = 400, \gamma_{xy} = 300, \text{ the strains are in multiple of } 10^{-6}$$

What is the maximum shearing strain in the material (in 10^{-6})?

- A. 250
- B. 750
- C. 500
- D. 1000

Ans. C

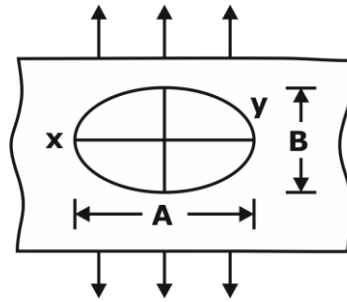
Sol. maximum shear strain, $\gamma_{\max} = 2\sqrt{\left(\frac{\epsilon_x - \epsilon_y}{2}\right)^2 + \left(\frac{\gamma_{xy}}{2}\right)^2}$

$$\text{maximum shear strain, } \gamma_{\max} = 2\sqrt{\left(\frac{800 - 400}{2}\right)^2 + \left(\frac{300}{2}\right)^2}$$

$$\gamma_{\max} = 2\sqrt{200^2 + 150^2}$$

$$\gamma_{\max} = 500$$

50. A loaded semi-infinite flat plate is having an elliptical hole $\left(\frac{A}{B} = 3\right)$ in the middle as shown in the figure below. The stress concentration factor at points either X or Y is



- A. 1
- B. 3
- C. 5
- D. 7

Ans. D

Sol. $K = 1 + \frac{2A}{B} = 1 + 2 \times 3 = 7$

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