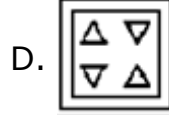# HAL MT 2022
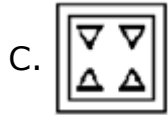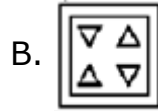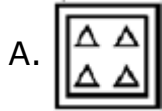
Mechanical Engineering

Sample Question Paper

Questions & Answer Key

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

   JMPQ : HKNO : : LCOP : ?

   A. JANM   B. JAMN

   C. MAJP   D. JANN

Ans. B

2. Stayen starts walking towards North. After walking 70 m he turns to left and walks 35 m straight. He then turns to left and walks 30 m, again he turns to the left and walks a distance of 35 m. How far is he from the starting point and in which direction?

   A. 35m, South   B. 35m, North

   C. 40m, North   D. 40m, South

Ans. C

3. If 'P 3 Q' means 'Q is the daughter of P', 'P 5 Q' means 'Q is the son of P', 'P 7 Q' means 'P is the sister of Q', 'P 9 Q' means 'P is the brother of Q'. Which of the following expression indicates A is the nephew of D?

   A. B 9 D 5 C 5   B. B 7 D 7 C 3 A

   C. B 7 D 9 C 5 A   D. B 7 D 9 C 3 A

Ans. C

4. In a certain code language, "SATURN" is written as "JVQXWW" and "URANUS" is written as "OYJENY". How is "JUITER" written in that code language?

   A. NIPMQN   B. NIPMYF

   C. NQMPIN   D. FYLMPI

Ans. A

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

   A. DWEV   B. HSIR

   C. KPLO   D. PKQI

Ans. D

6. A piece of paper is folded and punched as shown below in the question figures. From the given answer figures, indicate how it will appear when
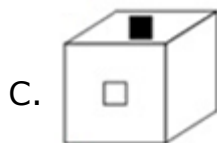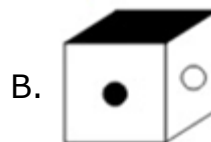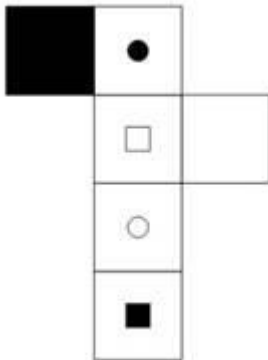
opened?

A.

B.

C.

D.

Ans. C

7. Present age of a father is 3 times that of his son. After 10 years the son's age will be 5 times of Raman's present age. If Raman celebrate his third birthday 2 years ago, then what is the present age (in years) of father?

A. 45

B. 40

C. 36

D. 39

Ans. A

8. From the given options, which answer figure can be formed by folding the figure given in the question?

A.

B.

C.

D.

Ans. D

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

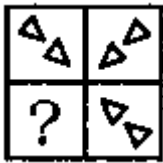AN, BO, CP, DQ, ?

A. EG   B. ER
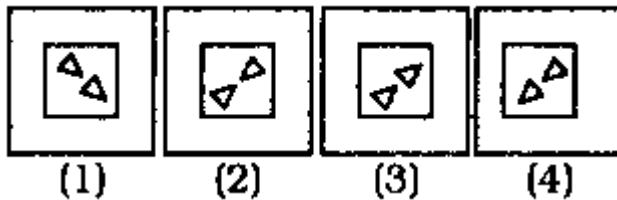
C. EH   D. EF

Ans. B

10. Directions : In each of the following questions, which answer figure will complete the question figure?

Question figure:

Answer Figure

A. Figure (1)   B. Figure (2)

C. Figure (3)   D. Figure (4)

Ans. C

11. **In the sentence, identify the segment which contains the grammatical error.**

He laughed on her as she fell off the tree.

A. she fell   B. He laughed on

C. off the tree   D. her as

Ans. B

Sol. Option B has the grammatically incorrect part. The correct preposition with "laugh" should be "at" and not "on". "Laugh at someone" means to mock someone or to say unkind things about someone.

12. **In the sentence, identify the segment which contains the grammatical error. If the sentence has no error, then select 'No error'.**

Each of the girls in my class sing well.

A. Each of the girls   B. in my class

C. sing well   D. No error

Ans. C

13. **Choose the most appropriate answer and fill in the blanks:**

If you had _____ you would have certainly got the scholarship.

A. worked hard   B. been worked hard

C. work hard   D. have worked hard

Ans. A

14. **Select the most appropriate option to fill in the blank.**

After he had _____ Mathematics, he went straightway to his room and took the online test.

A. practiced   B. practiced

C. practice   D. done practised

Ans. A

15. **Choose the most appropriate option to change the voice (active/passive) form of the given sentence.**

The child tore the page of the book.

A. The page of the book was torn by the child.

B. The page of the book tore by the child.

C. The book's page is torn by the child.

D. The page of the book is tearing by the child.

Ans. A

16. Choose the option that is the passive form of the sentence.

Shyam saw Abhishek starting the car.

A. Abhishek has seen Shyam starting the car.

B. Abhishek can be seen starting the car by Shyam.

C. Abhishek was seen starting the car by Shyam.

D. Abhishek was saw by Shyam starting the car.

Ans. C

17. Identify the best way to improve the underlined part of the given sentence. If there is no improvement required, select 'no Improvement'.

We hurried to the door, but nobody is there.

A. nobody was there   B. nobody are there

C. nobody were there   D. No improvement

Ans. A

18. **Identify the best way to improve the underlined part of the given sentence. If there is no improvement required, select 'no Improvement'.**

We were not <u>used to get up</u> early.

A. used to getting up

B. getting up

C. used to be up

D. no improvement

Ans. A

19. **Select the correctly spelt word.**

A. Sattalite

B. Satellite

C. Satallite

D. Satalight

Ans. B

20. Select the word which means the same as the group of words given.

To renounce one's throne

A. abdicate

B. arrogate

C. abstain

D. abrogate

Ans. A

21. Where did Gautam Buddha took his Samadhi?

A. Patna

B. Kushinagar

C. Varanasi

D. Sarnath

Ans. B

22. Mohandas Karamchand Gandhi was awarded the Kesar-e-Hind Award in 1915 by _____ of Penhurst for his contribution to ambulance services in South Africa.

A. Lord Dalhousie

B. Lord Harding

C. Lord Ripon

D. Lord Curzon

Ans. B

23. From which of the following continent, all three latitudes i.e. equator, tropic of cancer and tropic of Capricorn pass?

A. North America

B. Asia

C. South America

D. Africa

Ans. D

24. Who was the first Indian to ski to the North pole?

    A. Neal Paramjit   B. Arun Nayyar

    C. Ajeet Bajaj   D. Sanjay Thapar

Ans. C

25. Which of the following is the correct sequence of countries in terms of maximum carbon dioxide emission?

    A. China, USA, European Union, India

    B. USA, India, China, European Union

    C. China, India, European Union , USA

    D. European union, China, USA, India

Ans. A

26. Who is also known as 'Light of Asia'?

    A. Gautam Buddha   B. Jesus Christ

    C. Prophet Mohammad   D. Swami Vivekanand

Ans. A

27. What is the minimum age required to become a member of Rajya Sabha?

    A. Twenty years   B. Thirty years

    C. Twenty-two years   D. Twenty-five years

Ans. B

28. Article 370 of the Indian Constitution was related to which state?

    A. Jammu and Kashmir   B. Gujarat

    C. Tamil Nadu   D. Bihar

Ans. A

29. Which of the following is NOT recognized as an Intangible Cultural Heritage (ICH) by UNESCO?

    A. Sitar Vadan   B. Yoga

    C. Kumbh Mela   D. Chhau Dance

Ans. A

30. Who has authored the book 'The Unseen Indira Gandhi'?

    A. Jayram Naresh   B. Dr. K P Mathur

    C. Dr. Anna Suvorova   D. Santosh Singh

Ans. B

31. A spring controlled governor is said to be stable if controlling force (F) and the radius of rotation (r) obey the relation (where, a and b are constants):

   A. F = ar
   B. F = ar +b
   C. F = ar − b
   D. F = a/r

Ans. C

32. Consider two infinitely long concentric cylinders with a diameter ratio $D_2/D_1 = 5$. The shape factor for the outer cylinder with itself is

   A. 1
   B. 0.8
   C. 0.36
   D. 0.64

Ans. B

33. Multi-cylinders engine gives_____.

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

Ans. A

34. A closed-coil helical spring is subjected to a torque about its axis. The spring wire would experience a_____.

   A. bending stress

   B. direct tensile stress of uniform intensity at its cross-section

   C. direct shear stress

   D. torsional shearing stress

Ans. A

35. If number of turns are 8 and wire diameter of spring is 3mm, then solid length of the helical spring is given by?

   A. None of the listed
   B. 27mm

   C. 24mm
   D. 21mm

Ans. C

36. A mass of 10 kg connected at the end of a rod of negligible mass is rotating in a circle of radius 30 cm with an angular velocity of 10 rad/s. If this mass is brought to rest in 10 s by a brake, what is the magnitude of the torque applied?

   A. 0.9 N-m
   B. 1.2 N-m

   C. 2.3 N-m
   D. 0.5 N-m

Ans. A

37. In a single server infinite population queuing model, arrivals follow a Poisson distribution with mean λ = 4,per hour. If the service time equal to 12 minutes. Then the expected length of the queue will be

   A. 4   B. 3.2

   C. 1.25   D. 5

Ans. B

38. Strain hardening is due to _____.

   A. Fracture mechanism   B. Dislocation mechanism

   C. Twinning mechanism   D. twist mechanism

Ans. B

39. In the expression of dynamic load capacity $P=XVF_r + YF_a$, V stands for ?

   A. Race rotation factor   B. Radial factor

   C. Thrust factor   D. None of the listed

Ans. A

40. The static deflection of a shaft under a flywheel is 4 mm. What is the critical speed in rad/sec if g= 10 m/s^2:

   A. 50   B. 20

   C. 10   D. None of these

Ans. A

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

   A. Tension in both

   B. Tension in aluminium, compression in steel

   C. Compression in both

   D. Compression in aluminium, tension in steel

Ans. D

42. The equation $\left(P+\dfrac{a}{v^2}\right)(v-b) = RT$ is known as_____.

   A. Real gas equation   B. Maxwell's equation

   C. Vander wall's equation   D. Ideal gas equation

Ans. C

43. If the principal stress in plane stress problem σ_1 = 200 MPa, σ_2 = 50 MPa, the magnitude of the maximum IN PLANE shear stress (in MPa) will be

A. 125 MPa   B. 100 MPa

C. 75 MPa   D. None of these

Ans. C

44. Coefficient of contraction is the ratio of

A. Actual velocity of jet at vena contracta to the theoretical velocity

B. Loss of head at the orifice to the head available at the exit of the orifice

C. Actual discharge through an orifice to theoretical discharge

D. Area of the jet at vena contracta to the area of orifice

Ans. D

45. For maximum efficiency, the Optimum velocity ratio for a 4-rows Curtis turbine is

A. $\frac{\cos\alpha}{4}$ B. $\frac{\cos\alpha}{8}$

C. $\frac{\cos\alpha}{12}$ D. $\frac{\cos\alpha}{16}$

Ans. B

46. Which container is having maximum pressure at bottom of container_____?

(with all having same liquid)?

A. A & C having same pressure   B. D

C. Data insufficient   D. All having same pressure

Ans. D

47. For a diesel cycle the compression ratio is 21 and the cutoff ratio is 3. Calculate the expansion ratio ?

A. 63   B. 7

C. 24   D. 18

Ans. B

48. The Application of Wood powder in mold making is_____.

A. To increase porosity & collapsibility

B. To increase refractoriness property

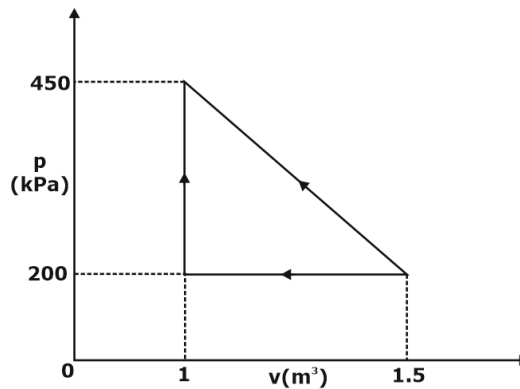C. To increase resistance to deformation

D. None of the above

Ans. A

49. A thin cylinder of diameter 15 mm, thickness 3 mm, pressure 10 N/m² and Poisson's ratio 0.5, the longitudinal strain is _____.

A. 37.5   B. 12.5
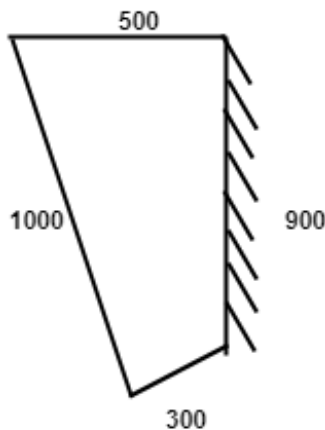
C. 0.0   D. Data insufficient

Ans. C

50. Work output (in KJ/cycle) for the cycle shown in the below figure will be

A. 125   B. 62.5

C. 250   D. 500

Ans. B

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

A. Double rocker mechanism   B. Crank rocker mechanism

C. Double crank mechanism   D. Linkage is not planar

Ans. B

52. For maintaining high efficiency in a Pelton turbine, the value of D/d lies in the range of _____.

Where D is wheel pitch diameter and d is jet diameter.

A. 8 to 12   B. 12 to 14

C. 14 to 16   D. 12 to 18

Ans. C

53. Lumped Heat-transfer analysis of a solid object suddenly exposed to a fluid medium at a different temperature is valid when _____.

A. Biot number < 0.1   B. Biot number > 0.1

C. Fourier number < 0.1   D. Biot number < 0.01

Ans. A

54. In a four-bar mechanism, two adjacent links are rotating at angular velocities of 5 rad/s (clockwise) and 10 rad/s (anti-clockwise). If the radius of the pin joining the links is 3 cm, then what is the value of rubbing velocity:

A. 15 cm/s   B. 30 cm/s

C. 40 cm/s   D. 45 cm/s

Ans. D

55. Strength of the various welding joints is affected due which of the following factors:

A. Crack initiation   B. Residual stresses

C. Stress concentration   D. All of these

Ans. D

56. Which of the following cycles has unequal expansion & Compression strokes _____?

A. Stirling Cycle   B. Atkinson cycle

C. Joule Cycle   D. Ericsson cycle

Ans. B

57. In USM (ultrasonic machining process) with increase in abrasive particle size the material removal rate _____

A. Increases   B. decreases

C. first increases then decrease   D. first decreases then increases

Ans. C

58. Nitriding, a heat treatment process, will_____.

A. Improve ductility

B. Improve the hardness of the whole mass

C. Increase the surface hardness

D. Refine grain structure

Ans. C

59. A block of mass 4 kg is placed on a rough horizontal plane. A time dependent force $F = kt^2$ acts on the block, where $k = 2$ Ns^{-2}, Coefficient of friction $\mu = 0.8$. Force of friction between block and the plane as t = 2 s is

A. 8 N   B. 4 N

C. 2 N   D. 32 N

Ans. A

60. A body of mass 0.1 kg moving with a velocity of 10 ms^{-1} hits a spring (fixed at the other end) of force constant 1000 Nm^{-1} and comes to rest after compressing the spring. The compression of the spring is

A. 0.01 m   B. 0.1 m

C. 0.2 m   D. 0.5 m

Ans. B

61. The boiling point of ammonia is _____.

A. -10.5°C   B. -30°C

C. -33.3°C   D. -77.7°C

Ans. C

62. What is the speed of sound in Neon gas at a temperature of 500 K (Gas constant of Neon is 0.4210 kJ/kg-K) _____?

A. 492 m/s   B. 460 m/s

C. 592 m/s   D. 543 m/s

Ans. C

63. The effective temperature of a black body is 627°C, determine the wavelength of maximum monochromatic emissive power.

A. 3.22μm   B. 3.18μm

C. 3.45μm   D. 4.22μm

Ans. A

64. The pressure 'P' and volume 'V' of an ideal gas of mass 'm' changes by ΔP and ΔV, respectively during an adiabatic process. The value of $(\Delta V/V)$ is given by

A. $-\frac{1}{\gamma}\left(\frac{\Delta P}{P}\right)$

B. $\frac{1}{\gamma^3}\left(\frac{\Delta P}{P}\right)$

C. $\left(\frac{\Delta P}{P}\right)$

D. $-\gamma\left(\frac{\Delta P}{P}\right)$

Ans. A

65. What is the bulk modulus of a material, if a cube of 100mm changes its volume to 998cm^3 when subjected to pressure of 250 x 10^6 Pa?

A. 250GPa

B. 125GPa

C. 100GPa

D. 200GPa

Ans. B

66. Which one of the following is extensive property of a thermodynamics system ?

A. Volume

B. Pressure

C. Temperature

D. Density

Ans. A

67. In Grinding wheel specification: A 76 M 8 S . Where S signifies_____?

A. Small Structure

B. Solid Structure

C. Silicate Bond

D. Shellac Bond

Ans. C

68. What does hydrostatic pressure in extrusion process improve ?

A. Ductility

B. Compressive strength

C. Brittleness

D. Tensile

Ans. A

69. Modulus of rigidity is the ratio of:

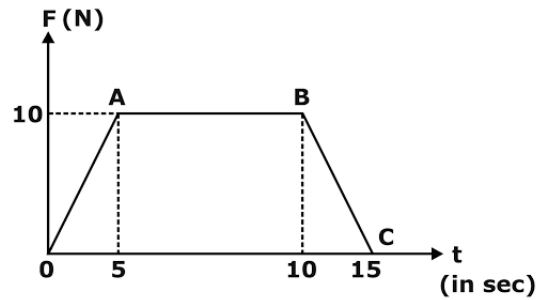A. Axial stress to lateral strain

B. Linear stress to longitudinal strain

C. Shear stress to shear strain

D. Hydrostatic stress to volumetric strain

Ans. C

70. The following figure shows a graph of force vs time. The net impulse (in N-s) will be

    A. 50   B. 100

    C. 150   D. 200

Ans. B

71. Manufacturing a product requires processing on four machines A, B, C, D in order A – B – C – D. The capacities of four machines are A = 100, B = 140, C = 90, D = 150 units per shift. If the expected output is 80% of the system capacity then what is the expected output?

    A. 80 units   B. 72 units

    C. 112 units   D. 120 units

Ans. B

72. The property of material by virtue of which it can be beaten or rolled into plates is called_____.

    A. Malleability   B. Ductility

    C. Plasticity   D. Elasticity

Ans. A

73. Cotter joint is used to transmit _____.

    A. Axial tensile load only

    B. Axial compressive load only

    C. Combined axial and twisting load only

    D. Axial tensile or compressive load

Ans. D

74. For cutting a rectangular blank of 50 mm × 200 mm from a sheet of 1 mm thickness (mild steel, shear strength= 240 N/mm²). The required force for blanking operation is _____ kN.

    A. 95   B. 110

    C. 115   D. 120

Ans. D

75. Using the table given below, calculate the six week moving average forecast for the 16th week.

Week	10	11	12	13	14	15
Demand (units)	105	115	120	140	135	116

A. 122   B. 134

C. 120   D. 118

Ans. A

76. In a steady fluid flow, identical ones are_____.

A. Path line and stream line

B. Stream line and streak line

C. Path line and streak line

D. Path line, stream line and streak line

Ans. D

77. An aqua-ammonia absorption refrigeration plant uses heat from a generator by condensing steam at 127°C. The temperature maintained in the refrigerator is -23°C and the ambient temperature is 27°C. The maximum possible COP of the plant is

A. 1.25   B. 2.5

C. 4   D. 5

Ans. A

78. Velocity of sliding at the beginning of engagement of the two gears = ($\omega_p + \omega_g$) x _____.

A. Path of recess   B. Arc of contact

C. Arc of approach   D. Path of approach

Ans. D

79. Which conditions shows that flow separation has occurred in the boundary layer _____.

A. $\left(\dfrac{\partial u}{\partial y}\right)_{y=0} = 0$

B. $\left(\dfrac{\partial u}{\partial y}\right)_{y=0} < 0$

C. $\left(\dfrac{\partial u}{\partial y}\right) < 0$

D. $\left(\dfrac{\partial u}{\partial y}\right)_{y=0} > 0$

Ans. B

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

A. side cutting edge angle

B. rake angle

C. nose radius of tool

D. End cutting edge angle

Ans. A

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