NUMERICAL ANSWERS TO CALCULATION QUESTIONS

Note: The following units contain calculation questions.

Unit 1 - Elementary Mechanics and Dynamics

Chapter 1 - Introduction to Basic Mechanics

3. 0.0013 km/s^2
4. 1.44 km/min
5. First speed: 37.5 km/h

   Second speed: 40 km/h

   Average speed: 38.71 km/h
6. 49.76 m/s
7. 4 m/s^2
10. Work = 1 569 600 J or 1569.6 kJ

    Power = 26.2 kW
11. 73 575 J
12. c) 312.5 J

Chapter 2 - Forces and Moments

2. 365 N, Direction of the force = acting sideways to the right
5. 50 Nm clockwise
6. 1500 kNm
7. 6 kg
8. 10 N
10. 1500 N
11. 4000 N
12. 100 N
13. R_2 = 300 N, R_1 = 420 N

Chapter 3 - Simple Machines

3. 15
4. 0.57 kN
5. a) 4.5 kN

   b) 15
6. 594.05 N
8. a) 8

   b) 122.63 N
9. a) 15

   b) 157 N
10. 79.97%
11. 2256.3 Nm

Chapter 4 - Scalars and Vectors

5. 10 kN

Chapter 5 - Linear Velocity and Acceleration

1. 354.15 m
3. 19 m
4. 1.26 km/min
5. 40 km/h (outward)

   52 km/h (return)

   45.22 km/h (double)
6. Time taken = 12.96 s
   Acceleration = 4.29 m/s^2

7. 0.152 km

9. 2.6 m/s^2

10. s = 103.2 m

    t = 9.2 sec

11. 39.76 m/s

    200.74 m

Chapter 6 - Force, Work, Pressure, Power, and Energy

4. 1.4 kJ

5. 56.6 kJ

6. 1019 kg

10. 120 kN

12. 790.3 kPa

16. 10 kW

17. 85.71%

20. 30.65 kJ

    22.99 kJ

21. 24.26 m/s

22. 771.60 MJ

Chapter 7 - Friction

6. 0.3295

7. 2157.66 kg

8. 529.74 N

9. a) 784.8 N

   b) 490.5 N

Chapter 8 - Stress and Strain

4. 31 222 kPa

5. 0.00015

6. 8.72

7. 377 kN (force of the punch)

   1200 MPa (stress of the punch)

8. a) 29.26 kN

   b) 4.88 kN

9. a) 20%

   b) 53.3%

Chapter 9 - Power Transmission

3. 5.23 m/s
4. 150 r/min
5. 200 r/min
9. 30 kW
10. 12 kW
15. 2000 r/min
18. 20 r/min

Unit 2 - Elementary Physical, Chemical, and Thermodynamic Principles

Chapter 1 - Introduction to Matter and Chemistry

31. 1.2694 kg of O_2 will be removed.
32. $CaCO_3 + 2Na^+ = Ca^{+2} + Na_2CO_3$

Chapter 2 - Introduction to Thermodynamics

25. 2.273 kJ
26. 0.4058 kJ/kg/°C
27. 75.05 °C
28. 1.10 kg
29. 0.251 m
30. 16.5×10^{-6}/°C
31. 97.42°C
32. 1.24 m

Chapter 4 - Thermodynamics of Steam

17.

Dry and Saturated Steam @ 600 kPa	
Saturation temperature	158.85°C
Specific volume of steam	315.7 kJ/kg
Enthalpy of water	670.56 kJ/kg
Enthalpy of steam	2756.8 kJ/kg
Sensible heat in water	670.56 kJ/kg
Latent heat in steam	2086.3 kJ/kg

18. a) 151.86°C

    b) 5562.7 kJ

    c) 335 kJ/kg

    d) 4189.6 kJ

19. a) Original = 1200 kPa, Final = 2.339 kPa

    b) 1.0018 cm^3/g

20. 27 124.4 kJ

21. a) 3278.2 kJ/kg

    b) 26 225.6 kJ

Unit 8 - Basic Concepts in Electrotechnology

Chapter 1 - Basic Electricity

15. 5.5 A

16. 220 V

17. 150 V

18. a) Supply voltage = 100 V

    b) 40 Ω resistance = 2.5 A, 50 Ω resistance = 2.0 A

    c) Total line current = 9.5 A

19. 22 Ω

26. 210 Ω

27. 22 Ω

28. 30 Ω

29. 40 Ω

32. 1650 watts

33. 18.1 A

34. No, it is not feasible to operate both on a single 15-A circuit.

35. 17.82 Ω

36. 630 kJ

Chapter 4 - Motors and Generators

32 a) 38.4 kVA

   b) 34.56 kW

33 a) 0.95

   b) 36 kVA

   c) 34.2 kW

Chapter 5 - Transformers

6. 1760 V
7. Voltage = 440 V

   Current = 2 A,

   Power = 800 W
8. The first transformer = 300 Turns

   The second transformer = 40 Turns

   The first transformer = 120 Turns

Unit 12 - Elements of Boiler Systems

Chapter 1 - Combustion

19. 16.42 m^3/kg
20. 7.08 kmol C

    11.91 kmol H

    0.039 kmol S

Chapter 2 - Fuel Delivery and Firing Systems

77. 46%

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