PHS 101

Course Synopsis

Unit and dimensions, rectilinear motion, Newton's law, friction, Equilibrium moment force, simple harmonic motion, work, energy and power, elasticity, temperature, law of thermodynamics.

Unit and Dimensions

1. Which of the following is not a fundamental S.I unit?
   [a] Meter [b] Ampere [c] Kelvin [d] Second
   [e] Radian [f] None of the above
2. Which of the following is a derived unit?
   [a] Kg [b] Meter [c] Kelvin [d] Newton
3. The international agreed system of unit (SI) for physical measurement is
   [a] Ib, Ft,. Sec [b] G, m, sec
   [c] Kg, m, sec [d] Kg, cm, sec
4. Which of the following is a fundamental unit?
   [a] Newton [b] Joule [c] Watt [d] Ampere
5. Which of the following are the correct S.I units of the quantities indicated? (I) N (Force) (II) Nm^{-1} (torque) (III) Watt (power) (IV) $kgms^{-2}$ (momentum)
   [a] I & II only [b] I, II and III only
   [c] I, III and IV only [d] I and II only
6. Which of the following is equivalent to $kgms^{-1}$
   [a] Ns-1 [b] Nms [c] Ns [d] Js-1
7. Which of the following quantities her the same unit as the watt?
   [a] Force & Time [b] Force & Distance
   [c] Force & Acceleration [d] Force & Velocity
8. The physical quantity that has the same dimensions as impulse is
   [a] Energy [b] Momentum [c] Surface tension [d] Pressure
9. The dimension of the surface tensions are
   [a] $MT^{2}L^{-1}$ [b] $M^{-1}T^{-2}L^{-1}$ [c] MT^{-2} [d] $M^{2}T^{-2}$
10. Which of the following is the dimension of the pressure?
    [a] $ML^{-1}T^{-1}$ [b] MLT^{2} [c] MLT^{-2} [d] ML-3
11. At what perspective values of x, y and z would the unit of force, the mention, be dimensionally equivalent to M' L' T'
    [a] -1, 1, 2 [b] 1, 1, -2 [c] 1, -1, 2 [d] -1, 1, -2
12. For which of he under listed quantities is the derived unit ML 'T' correct
    [a] I only [b] II only [c] I & II [d] II & III

For question 13, 14 and 15

A volume of liquid passing per second, V/T through a pipe where the flow is steady given that V depends on coefficient of viscosity of the liquid, radius (R) of the pipe and the pressure gradient P/L cause the flow.

13. Which of the following is the correct dimensional expression?
    [a] $L^{3}T^{4} = (MLT)^{X} L' (ML^{-2}T^{-2})^{Z}$
    [b] $L^{3}T^{1} = (MC^{+}T^{2})^{X} L' (ML^{-3}T^{-2})^{z}$
    [c] $L^{2}T^{8} = (^{MI\ 1}T^{-2})^{X} L^{2}(ML^{-2}T^{-2})^{2}$

[d] $L^{3}T^{-1} = (M\ L\ T)\ L\ (ML\ T)$

14. What are the values of x, y and z

[a] X = -1, y = 4 and z = 1 [b] X = -2, y = 3 & z = 0

[c] X = 1, y = 4, Z = 1 [d] X = 1, y = 4 & Z = -1

[e] X = -2, y = -3 and Z = 1

15. Which of the following is the correct expression for the value V

[a] $V = \frac{Kpr^{3}}{\eta L}$ [b] $V = \frac{KPr^{4}}{\mu L}$

[c] $V = \frac{Kpr^{2}}{\eta^{2}L}$ [d] $V = \frac{Kpr^{4}}{\mu^{2}L}$ [e] $V = \frac{KP^{2}r^{3}}{\mu L^{2}}$

Rectilinear Motion

16. During the same internal, it is observed that a train travels the same distances as does a lorry. The two vehicles therefore have the same

[a] Uniform acceleration [b] Instantaneous velocity

[c] Initial velocity [d] Average velocity

[e] Average speed

17. A moving object has a uniform acceleration is it's

[a] Displacement increases at a constant rate

[b] Speed is directly proportional to time

[c] Velocity increases by equal amount in equal time intervals

[d] Velocity varies inversely with time

[e] Speed increases by equal amounts in equal time intervals

18. When a ball rolls on a smooth level ground, the motion of its center is

[a] Translatory [b] Oscillatory [c] Random [d] Rotational

19. The motion of a moving Skin of a talking drum can rightly be described

[a] Translational [b] Random [c] Rotational

[d] Oscillatory [e] Transitory

20. If a body moves with a constant speed and at the same time undergoes an acceleration its motion is said to be

[a] Circular [b] Oscillatory [c] Rectilinear [d] Rotation

21. A body start from rest and moves with constant acceleration which of the following quantities varies. Vary linearly with the square of the time? I. Velocity II Displacement III Momentum

[a] I only [b] II only [c] III only

[d] I and II only [e] II and III only

22. A train has an initial velocity of 44m/s and an acceleration of $4m/s^2$.its velocity after 10 second is

[a] 2m/s [b] 4m/s [c] 8m/s [d] 12m/s [e] 16m/s

23. A body accelerates uniformly from rest $2ms^{-2}$. Calculate its velocity after travelling 9m

[a] $35.00ms^{-1}$ [b] $18.00ms^{-1}$ [c] $6.00ms^{-1}$

[d] $4.50ms^{-1}$ [e] $4.24ms^{-1}$

24. A body starts from rest and mores in a straight path with uniform accelerates of $8ms^{-2}$ for 5 seconds. If then decelerate uniformly to rest in the next 10 seconds. Calculate the magnitude of it acceleration

[a] 80ms^{-2} [b] 16ms^{2} [c] 8ms^{-2} [d] 4ms^{-2} [e] 3ms^{-2}

25. A body falls from rest to the ground in 0.55. Calculate the height from which it falls (g = 10ms^{-2})

[a] 0.125m [b] 0.5m [c] 1.0m [d] 1.25 [e] 5.0m

26. A motor vehicle is brought to rest from a speed of 15m/s in 20s. Calculate the retardation

[a] 0.75m/s^{2} [b] 1.33m/s^{2} [c] 5.00m/s [d] 2.5m/s^{-2} [e] 5.0m/s^{-2}

27. A body moving with a velocity of 4m/s^{-1} is brought to rest by a constant from after travelling 20m. Calculate retardation

[a] 0.1ms^{-2} [b] 0.2ms^{-2} [c] 0.4ms^{-2} [d] 2.5ms^{-2} [e] 5.0ms^{2}

28. A body which is uniformly retarded comes to rest with a constant deceleration of 10ms^{2}. Calculate the distance traveled

[a] 10m [b] 20m [c] 200m [d] 400m

29. A car travelling at 20m/s^{-1} is brought to rest with a constant deceleration of 10m/s^{-2}. Calculate the distance traveled.

[a] 10m [b] 20m [c] 200m [d] 400m

30. A car moving with a speed of 90km/hr was brought uniformly to rest by the application of the baker in 10s. How far did the car travel after the brakes were applied?

[a] 125m [b] 150m [c] 250m [d] 15km

NEWTON'S LAW OF MOTION

31. Newton's first law of motion states that a body continues in its state of rest uniform motion in a straight line unless.

[a] The composition of the body is changed
[b] The forces of gravity changes
[c] There is action and reaction
[d] Forces are impressed on the body
[e] There is no change in the direction of motion of the body

32. Which of the following conclusion can be drawn from Newton's second law of motion?

[a] Force is proportioned to acceleration
[b] Force is proportioned to extension
[c] Force is proportioned to the product of mass and velocity
[d] Force is proportioned to the product of pressure and area
[e] Force is proportioned to impulse

33. A boy sets in a train moving with uniform speed on a straight track. If from his outstretched palm, he tossed a coin vertically upwards, the coins will fall.

[a] In front of his palm [b] Behind his palm
[c] Beside his palm [d] Into his palm

34. An air force jet flying with a speed of 33m/s went past an anti-craft gun. How far is the aircraft 5s later when the gun was fired?

[a] 838m [b] 3350m [c] 670m [d] 1675m [d] 67m

35. A constant force of 5N on a mass of 5kginitially at rest. Calculate the final

momentum

[a] 125kgms^{-1} [b] 25kgms^{-1} [c] 15kgms^{-1} [d] 5kgms^{-1} [e] 0km^{-1}

36. A resultant force of 15N acts for 6s on a body of mass 4kg. Calculate the change in Momentum of the body within this period

[a] 3.75kgms^{-1} [b] 10kgms^{-1} [c] 22.50kgms^{-1}

[d] 90.00kgms^{-1} [e] 360kgms^{-1}

37. A body of mass 100g moving with a velocity of 10m/s, collide with a wall. If after the collision, it moves with a velocity of 2m/s in the opposite direction. Calculate change in momentum

[a] 0.8Ns [b] 1.2Ns [c] 12Ns [d] 80NS

38. When taking a penalty kick, a footballer applied a force of 30N, for a period of 0.03s. If the mass of the ball is0.075kg, calculate the speed with which the ball moves off.

[a] 4.50ms^{-1} [b] 11.25ms^{-1} [c] 20.00ms^{-1} [d] 45.0ms^{-1}

39. A jet engine develops a thirst of 270Ns when the velocity of the exhaust gases relative to the engine is 300ms^{-1}. What is the mass of the material ejected per second?

[a] 81.00kg [b] 9.00kg [c] 0.90kg [d] 0.0009

40. A rocked bums fuel at the rate of 10kg/s and ejects it with a velocity of 5 x 10^3. The thrust exerted by the gas on rocket is

[a] 2.5 x 10^7N [b] 5 x 10^4N [c] 5 x 10^2N [d] 2 x 10^{-3}N

FRICTION

41. The friction which operates when one solid surface slides over another is called

[a] Solid Friction [b] Static Friction

[c] Limiting Friction [d] Dynamic Friction

42. Which of the following about friction is NOT correct?

[a] Cars are less likely to skid on wet than on dry roads

[b] Nails bold boards together by friction

[c] Limiting friction is directly proportioned to the force acting between two surfaces

[d] Sliding friction is less limiting friction

[e] Lubrication reduces friction

43. The limiting frictional force between two surfaces depends on

I. the normal reaction between the surfaces

(II) The area of surfaces in contact

(III) The relative velocity between the surfaces
(IV) The Nature of the surfaces
[a] I only [b] II only [c] III only
[d] I & IV only [e] I & III only

44. What is the co-efficient of state friction between a load of mass 0.75kg and a horizontal surface, if the limiting fractioned force is 5N? ($g = 10ms^{-2}$)
[a] 0.066 [b] 0.15 [c] 0.66 [d] 1.50 [e] 3.75

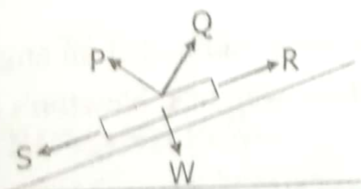
45. A force of 20N, applied parallel to the surface of a horizontal table is just sufficient to make book of mass 4kg move on the table. What is the co-efficient of fiction between the surfaces of the block and the table? ($g = 10ms^{-2}$)
[a] 0.2 [b] 0.5 [c] 2.0 [d] 5.0 [e] 8.0

46. A child pulls a toy car weighing 3.0kg along a cement floor. If $g = 10ms^{-2}$ and the co-efficient of friction is 0.500, the minimum force repaired to move the car is
[a] 3.0N [b] 5.0N [c] 10.0N [d] 15.0N [e] 60.0N

47. A boy pushes a 500kg box along a floor with force of 200N. If the velocity of the box is uniforms, the co-efficient of friction between box and the floor is
[a] 1 [b] 0.8 [c] 0.65 [d] 0.5 [e] 0.4

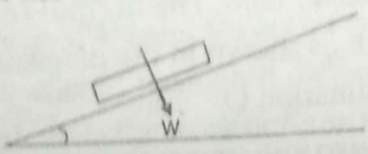
48. A box of mass 50kg is green an initial speed of 5m/s on a rough horizontal floor. If it slides on the floor for 3m before it stops. Calculate the co-efficient of kinetic friction between the block and the floor.
[a] 3/10 [b] 1/30 [c] 5/12 [d] 2/3 [e] 5/6

49.



In the diagram above, a car with its engine off, rolls down a slope with uniforms speed. Which one of the following is correct about the frictional force between the car and the road, it is
[a] Zero [b] In the direction of OP [c] In the direction of OQ
[d] In the direction OR [e] In the direction OS

50.

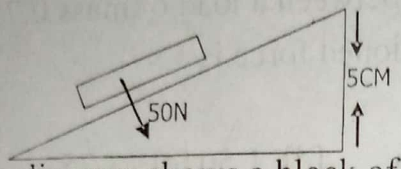


The figure show a block of hind weight W just on the point of sliding down on a rough plane include at an angle) to the horizontal. What is the co-efficient of friction between the block and the plane?

[a] W tan Θ [b] Tan Θ [c] W Cos Θ

[e] CosΘ [e] W Sin Θ

51.



The diagram shows a block of hind resting on an inclined plane and at the point of sliding down the plane. Calculate the co-efficient of friction between the blocked the plane

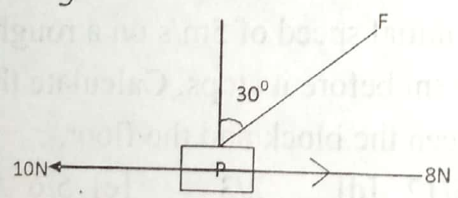
[a] 0.1 [b] 0.2 [c] 0.3 [d] 0.4 [e] 0.5

52. A wooden block of weight 16N is placed on a rough surface. If the co-efficient of friction between both surface is 0.25, the least horizontal force repaired to move the block is

[a] 0.4N [b] 4.0N [c] 6.4N [d] 64N

53. Two horizontal forces 10N and 8N and another force, F included at 30°to the vertical acting as shown in the diagram below, keep the body p in equilibrium. The weight of the body is

[a] $2\frac{\sqrt{3}}{3}$N [b] $\sqrt{3}$N [c] $4\sqrt{3/3}$N [D] $2\sqrt{3}$N5

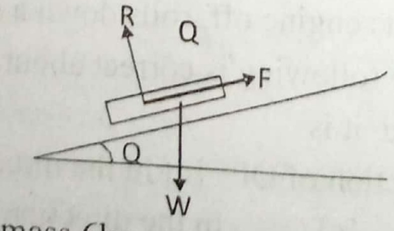


54.

A body of weight (w) rest on a smooth plane inclined at an angle to the horizontal. What is the resolved part of the weight I. Newton's along the plane?

[a] W Sin Θ [b] W Cos Θ [c] W sec Θ [d] W tan Θ

55.



A body of mass 6kg rest on an inclined plane. The normal reaction is R and the limiting frictional forces is F as shown in the diagram if F is 30N and g =10ms-2 then an angle of inclination O

[a] 15° [b] 30° [c] 60° [d] 75°

56. A body of mass 10kg rest on an angle inclined plane whose angle 15 tilt O is variable O is gradually increased until the body starts to slide down the plane at 30. The co-efficient of limiting friction on the body and plane is

[a] 0.30 [b] 0.50 [c] 0.58 [d] 0.87

57. A body of mass is placed where angle of inclination is 30. Find the resultant force acting down the shape and the acceleration if a frictional force of 5N acts between the body and the inclined surface

[a] 2.5m/s [b] 2m/s [c] 1.5m/s [d] 3m/s

58. Find the force parallel to the slope required to move a body of its 2kg up a slope inclined at 30 to the horizontal with an acceleration of $2m/s^2$ of the frictional force between the two surfaces is 10N

[a] 24N [b] 20N [c] 18N [d] 16N

59. A body of mass 4kg is on the point of slippering down on a plane which is inclined at 30 to the horizontal. What force, parallel to the plane will just move it up the plane ($g=10mms^{-2}$)

[a] 40N [b] 30N [c] 20N [d] 10N

60. The co-efficient of static friction between a 40kg crate and a concrete surface is 0.25. Find magnitude of minimum force needed to keep the crate stationary on the concrete base inclined at 45 to the horizontal ($g = 10ms^{-2}$)

[a] 400N [b] 300N [c] 283N [d] 212N

61. A body rolls down a shape from a height of 100m. Its velocity at the foot of the slope is 20m/s. what percentage of its initials potential energy converted into the kinetic energy?

[a] 40% [b] 35% [c] 20% [d] 15%

WORK, ENERGY AND POWER

62. A constant force of 40N acting on a body initially at rest gives it an acceleration of $0.1m/s^2$ for 4s. Calculate the work done by the force

[a] 8j [b] 10j [c] 32j [d] 160j

63. The area under a force distance graph represents

[a] Acceleration [b] Velocity [c] Power
[d] Work [e] Momentum

64. Two forces of 4N and 6N act on an object at an angle of 60 to each other. If the object is moved through a distances of 5m in the direction of the resultant force, calculate the work done on the object by the forces

[a] 51.96J [b] 43.59J [c]36.06J [d]26.83J [e] 26.46J

65. Calculate the work done in raising 700kg OF Iron ore to the surface from a depth of 80m

[a] 7.5 x 10^5y [b] 5.8 x 10^5J [c] 5.6 x 10^5J [d] 2.6 x 10^5J

66. A body of mass 10kg falling freely attains a velocity of $9ms^{-1}$ at a height of 20m above the ground. Calculate the total energy at that height

[a] 100J [b] 2000J [c] 2045J [d] 2045J [e] 2810J

67. A stationery stone at a height xcm above the ground possess one of the following types of energy

[a] Mechanical Energy [b] Stationery Energy
[c] Potential Energy [d] Vibrational Energy

68. What is kinetic energy of a body of mass 200kg moving with a velocity of $10ms^{-1}$?

[a] 1.0 x 103Y [b] 2.0 x 103J [c] 5.0 x 103J
[d] 1.0 x 104J [e] 2.0 x 104J

69. The average power required to lift a 50kg load to a height of 25m in 2minutes is

[a] 6250.00watts [b] 625 .00 watts
[c] 104.17 watts [d] 10.42watts

70. How long will it take a 60kg man to climb a height of 22m if he expended energy at the rate of 0.25kw?

[a] 5.3s [b] 34.5s [c] 41.6s [d] 52.8s

71. Which of the following are contact forces?

[I] Force of tension [II] Force of friction
[III] Magnetic force [IV] Force of reaction
[a] I, II and III only S [b] I, II and IV only
[c] I, III and IV only [d] II, III and IV only
[e] I & IV only

72. Given the gravitational constant is 7 x $10^{11}Nm^2kg^{-1}$, what is the force of attraction between 106kg mass of copper hanging one meters away from a 103kg mass of iron.

[a] 7 x 1-20N [b] 7 x 10^8N [c] 7 x 10^{-2}N
[d] 7 x 10^3N [e] 7 x 10^8N

73. An astronaut experience weightlessness in space when he

[a] Does not hold anything mile in space
[b] Is midway between the sun and the earth

[c] Is free from the earth gravitational field

[d] Is walking on the moon

74. A body is projected from the earth surface with the intention of letting it escape from the earth's gravitational field. What is the minimum escape velocity of the body?

[a] $14kms^{-1}$ [b] $13kms^{-1}$ [c] $12kms^{-1}$

[d] $11kms^{-1}$ (Earth radius = $6.4 \times 10^{3}km$, g = $10ms^{-2}$)

75. The gravitational potential energy of a body of mass 5kg, situated at a point within the earth's gravitational field is $3.25 \times 10^{7}J$. Calculate the magnitude of the escape velocity of the body

[a] $5.50 \times 10^{4} ms^{-1}$ [b] $1.12 \times 10^{4}ms^{-1}$

[c] $6.25 \times 10^{3}ms^{-1}$ [d] $3.60 \times 10^{3}ms^{-1}$

76. The point beyond which a stretched spring does not return to its original length is called the

[a] Breaking point [b] Electric Limit

[c] Spring Constant [d] Elastic Point [e] Release Point

77. A total length of a spring, when a mass of 20g is hung from at end is 14cm, while its total length is 16cm when a mass of 30kg is hung from the same end. Calculate the unstretched length of the spring assuming Hooke's law is obeyed.

[a] 9.33cm [b] 10.00cm [c] 10.66cm [d]12.00cm [e] 15.00cm

78. A force of 100N stretches an elastic string to a total length of 20cm. if an additional force of 100N stretches the string 5cm further. Find the Natural length of the string

[a] 15cm [b] 12cm [c] 10cm [d] 8cm [e] 5cm

79. The energy per unit volume of stretched wire given by the relation (E = Energy per volume) is

[a] E = 2 strain x stress [b] E = 2 strain = stress

[c] E = ½ stress = strain [d] E = ½ strain x stress

HEAT AND TEMPERATURE

(N.B) For Phs 101 and Phs 105

1. A thermometer, which was not accurately calibrated, indicated 0.5% at the lover fixed point and 106 at the upper fixed point. What is the time temperature when the thermometer registers 63.4c?

[a] 166.7°C [b] 59.6°C [c] 16.7°C [d]160.7°C [e] 69°C

2. An ideal gas at 170c has a pressure 0f 760mmHg and is compressed (I) Isothermally (II) Adiabatically until its volume is halved in each reversibly ($Cp = 2100, Cv = 1500Jkd^{-1}k^{-1}$)
[a] 360mmHg [b] 1820mmHg [c] 760mmHg
[d] 2010mmHg [e] 190mmHg

3. In case (I) the final temperature
[a] 17°C [b] 110°C [c] -17°C [d] -11°C [e] 34°C

4. In case (II) the final pressure
[a] 380mmHg [b] 1520mmHg [c] 760mmHg
[d] 2010mmHg [e] 190mmHg

5. In case (II) the final temperature
[a] 17°C [b] 11°C [c] -17°C

[a] 120 [b] -40 [c] 573.25 [d] 40 [e] 30

6. The absolute zero is scale equivalent to
[a] -273.15c [b] -273.25 [c] -273.15K [d] -273.15K

7. The temperature at which standard water vapour, pure water and ice are all in equilibrium is
[a] 272.16k [b] 273.16K [c] 273K [d] 273°c [e] 273°F

8. If a house thermostat is set to 70F, what is the temperature in Celsius scale?
[a] 23°C [b] 20°C [c] 25°C [d] 27°C [e] 273°C

9. At temperature are the Fahrenheit and Celsius scalars equal
[a] 40 [b] -40 [c] -30 [d] 30 [e] 25

10. Absolute zero temperature can be define as the temperature
[a] At which the average kinetic energy of particles making up a body is zero
[b] At which pure water changes to ice at standard atmosphere pressure
[c] Of zero degree on the Celsius scale
[d] At which pure water and steam co-exist

11. A temperature of 20°c is the same as
[a] 36F [b] 68F [c] 11.1F [d] 43.1F [e] 25F

12. The length of mercury thread when it is at O°c, 100°c and at an unknown temperature O is 25mm, 225mm and 175mm respectively. The value of O is
[a] 85.0°C [b] 88.0°C [c] 75.0°C [d] 70.0°C

13. The lower fixed point of a finally thermometer reads 2^0c while the upper fixed point is 100^0c. What is the true temperature when the thermometer reads 51^0c?

[a] 52^0C [b] 50^0C [c] 49^0C [d] 46^0C

14. The pressure on the gas of a constant volume gas thermometer at the ice point is 352mm of mercury and at steam point 815mm of mercury. Find the temperature when the pressure of the gas is 490mm of mercury

[a] 30K [b] 243K [c] 300K [d] 303k

15. The resistance of a platinum wire at the ice and steam points are 0.75 and 1.05 respectively. Determine the temperature at which the resistance of the wire is 0.90

[a] 43.0^0C [b] 50.0^0C [c] 69.0^0C [d] 87.0^0C

PHS 101 ANSWERS

1. OPTION E
The correct option is E as fundamental unit are m, kg, s, Ampere and Kelvin

2. OPTION D 3. OPTION C 4. OPTION D

5. OPTION D
Torque = moment – force x Nm not Nm^{-1}
Momentum = mass x velocity = $kgms^{-1}$ not $kgms^{-2}$

6. Option C
$Kgms^{-1}$ = kgm/s = mass velocity = momentum
But $F = \frac{m(v-u)}{E}$ = ft kgm/s = Ns

7. Option D
Work done = power = $\frac{\text{force x distance}}{\text{Time}}$ = f x v

8. Option B
Impulse = change in momentum = $kgms^{-1}$

9. Option C
Surface tension = $\frac{\text{Force}}{\text{Length}} = \frac{m \times a}{L}$
$= (m)(Lt^{-2}) = MT^{-2}$

10. Option A
Pressure = $\frac{\text{Force}}{\text{Area}} = \frac{m \times a}{A} = \frac{M(LT^{-2})}{L^2}$

11. Option B
Force = m x a = $M(LT^{-2}) = M^1L^1T^{-2} = M^XL^YT^{-2}$
x = 1, y = 1, z = 2

12. Option C
Moment = force x distance = M. a distance

$= M(LT^{-2}) \times L = ML^2T^{-2}$

Work = F x Distance = ML^2T^{-2}

Acceleration = $\frac{v}{t} = \frac{LT^{-1}}{t} = Lt^{-2}$

13. Option D

Volume/T = viscosity. Radius. Pressure gradients

$L^3T^{1} = ML^{-1}T^{-1}$ $\quad L^{-1}MLT^{-2}L^{-1}$

$L^3T^{1} = ML^{-1}T$ $\quad L^{-2}MLT^{-2}L^{y}$

14. If x = -1, y = 4, z = 1

$L^3T^{-1} = (ML^{-1}T^{-1})^{1} L^4(L^{-2}T^{-2}M)^{-1}$

$L^3T^{-1} = M^{-1}LTL^4L^{-2}T^{-2}$

$L^3T^{-1} = L^3T^{-1}$

Or you go back to the question and assign or y and z to each parameter but this is kind of shortcut.

15. No option

If V/T = viscosity. Radius. Pressure gradient

$V/T = U.L. \frac{Km}{S^2L}$

Hence $\frac{V}{T}$ = U F, $\frac{P}{L}$, V = $\frac{P\mu Rt}{L}$

16. Option E

Distance, time and average speed are scale quantities

Acceleration, velocity whether Instantaneous, average or initial are vector quantities related to displacement and time rather than distance and time.

17. Option C

Acceleration is the rate of change of velocity with the Uniform or constant acceleration is the rate of change of velocity with time that remains constant.

18. Option D

19. Option D

20. Option A

Circular molecules uniform speed and acceleration

21. Option B

For a body that start from rest

$V = at$, $s = ½at^2$, $v^2 = 2as$

Thus v & t, s & t^2

22. Option B

U = 44m/s, a = -4ms, t = 10

Using v = u + at. [V= 4m/s]

23. Option C

U = 0. a = 2m/s^{-2}, 9m

Using v^2, 2as, v = 6ms-1

24. Option D

Starting from rest U = 0 a- 8ms^{-2}. t = 5s

Using v = at = 40m/s
Decelerating to rest means from the end find or maximum velocity reached during the accelerating stage
Hence U = 40m/s, t = ws
Using u = at a = $4m/s^2$

25. Option D
Falling from rest is an example of accelerating motion under growth
I.e. h = $\frac{1}{2}gt^2$[t = -5s, g = $10ms^{-2}$]
H = 1.25m

26. Option A
U = 15m/s t = 20s
From a retarding motion to rest
U = at, s = $\frac{1}{2} at^2$, $u^2 = 2as$
U = at:. A = $0.75ms^{-2}$

27. Option C
U = 4ms-1 s = 20m
Using U = at, s = $\frac{1}{2}at^2$, $u^2 = 2as$
U_2 = 2at:. A = $0.4ms^{-2}$

28. Option C
T = 10s, s = 20m
From u = at:. a = n/t
For u = $\frac{2s}{T} = \frac{2 \times 20}{10} = 4ms^{-1}$

29. Option B
U = 20m/s a = $10m/s^2$
U^2=2as
:. S = 20m

30. Option A
U = 90km/hr   25m/s   v =0
U = at, s = $\frac{1}{2}at^2$, u^2 = 20s
S = $\frac{1}{2}at^2 = \frac{1}{2} \times n\, t^2 = \frac{1}{2}nt^2$
= ½ x 25 x 10 = 125m

31. Option D

32. OptionA
The second law states that force is proportional to the rate of change of momentum
F & $\frac{mv - mu}{t}$, F & $\frac{(v-u)}{t}$ F & ma
F & a (as mass is always constant)

33. Option D
A train moving uniform speed is similar to a stationary train. Hence, the coin tends to fall to the position from where it has been displaced. The coi thus falls into his palm

34. Option D
An air force jet

V = 335m...
3s ⟶ 5s
Anti-craft
Gum
Distance of the air craft = v x t = 335 x 5=1675m

35. Option B
$F = \frac{mv-mu}{t}$
From rest, n = 0, mu = 0, $F = \frac{mv}{t}$
Final momentum = mv = ft = 5v or 5 x 5 = 25kgms^{-1}

36. Option D
$F = \frac{mv = mu}{t}$:. Mv – mu = ft = change in momentum
:. Mv – mu = 15 x 6 = 90kgms^{-1}

37. Option B
Change in momentum = m(v-n)
For collusion in opposite direction
Change in momentum = m (n-[v]) = m(u + v)
:. Change in momentum = 100kg (10+2)ms^{-1}
100
= 1.2kgms^{-1} or Ns

38. Option C
F = 30N, t = 0.055, m = 0.075kg
F = ma, $F = \frac{m(v-n)}{t}$. m(v-n) = Ft
M (n) = Ft :. N = Ft = $\frac{30 \times 0.05}{0.075}$ = 20m/s

39. Option C
F = ma = m(v-n) :. M(v-n) = Ft
Mu = Ft when v = 0; m = Ft = 270Ns
n   300ms^{-1}
M = 0.9kg

40. Option B
M = 10kg/s, v = 5 x 10^{3}m/s
t
F = ma = $\frac{m(v-u)}{t}$, m(v-u) = Ft
Mu = Ft, F = mu = $\frac{m}{t}$ U = $\frac{10 \times 5\ 10^{3}}{t}$
= 5 x 10^{4}N

41. Option D
Limiting/static friction is the frictional force between two surfaces in contact just before one of the bodies moves. Sliding, kinetic or dynamic friction is the frictional force between two surfaces in contact when a body slides over another at contact speed.

42. Option A
As cars are more likely to skid on wet than on dry road because of friction

43. Option D
Friction depends on the nature of the surface in contact (the roughness or smoothness of the surface) and the normal reaction F = UR
Solid friction is independent on the area of the surface in contact and the relative velocity between the surfaces.

44. Option C
M = 0.75kg, W = mg + 0.5 x 10 = 7.5N
F = UR = UW = Using the limiting friction
$U = \frac{F}{Mg} = \frac{5}{7.5} = 0.66$

45. Option B
F = UR = UW = Umg
$U = \frac{F}{Mg} = \frac{20}{4 \times 10} = 0.5$

46. Option E
M = 3.00kg. w = mg = 3 x 10 = 30N
U 0.5, F = UR = UW = 0.5 x 30 = 1.5N

47. Option E
M = 500Kg, W = mg = 500 x 10 = 500N
F = 2000N
$U = \frac{\text{Force at constant velocity}}{\text{Weight}}$
For kinetic friction
$U = \frac{2000}{5000} = 0.4$

48. Option C
m = 50kg, W = mg = 50 x 10 = 500N, U = 5m/s
Distance traveled before it stops = 3m, hence
$s = \frac{1}{2}at^2$, U^2 2as, $a = u^2$, $F = \frac{ma}{2s} = \frac{mu^2}{2s}$

$F = \frac{50 \times 5^2}{2 \times 3} = \frac{1250}{6}$

$U = \frac{F}{W} = \frac{^{1250}/_{6}}{500} = \frac{5}{12}$

49. Option D

Friction always opposes motion

50. Option B

$U = \frac{F}{N}$ or tan Θ where Θ frictional angle

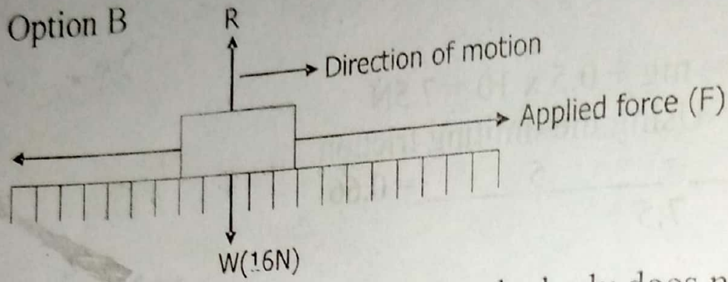
On the point of sliding, Θ = 0

Hence, U = tan Θ = tan Θ

51. Option B

$\text{Tan } \Theta = \frac{5}{25} = \frac{1}{5} = 0.2$

52. Option B



F – Fr = ma along the horizontal as the body does not accelerate

A = 0, ma = 0

F – Fr = 0 or F = Fr = UR

In the vertically, R = W

:. F = UR = UN = 0.25 x 16 = 4N

53. Option D

In equilibrium

i. Horizontal forces are balanced on either side

ii. Vertical forces are balanced on either side

Hence 10 = FSin30 + 8 as vertical to F is adjacent the angle is

Cos 10 = ½F + 8; F = 4N

Also for vertical, Fcos 30^0 = W as an angle acts vertically demand.

4Cos 30 = N

54. Option A

As the surface is smooth Fr = 0 along the plane. W = WSin0 as it is opposite the angle reserved part along the plane = WSin0 = A

55. Option A

As the body does not accelerate along The plane, WSin0 = F Perpendicular to the plane, R = WSin0

From WSin0 = , MgSin0 = F

6 x 10 SinΘ = 30

SinΘ = 0.5

Θ = 30^0

56. Option C

With no acceleration along the plane, Fr = WSinΘ perpendicular to theplane, R = WCos Θ (Draw diagram 1)

$U = \frac{Fr}{R} = \frac{WSin\Theta}{WCos\,\Theta} = \text{Tan}\Theta = \tan 30 = 1$

Hence W the point of sliding

Θ = Θ or U = tanΘ :. U = 1 = 0.58
3

57. Option A
(Draw diagram 1)
Resultant force along the plane = WSin0 – Fr
Resultant force = MgSin0 – Fr
= (2 x 10Sin30 – 5) – 5N
Resultant force along the plane = ma
5 = 2 x a
$A = 2.5ms^{-2}$

58. Option A
(Draw diagram 1)
Along the plane F – (WSinΘ + Fr) = ma
F = ma + mgSinΘ + Fr
F = 2(2) + (2 x 10Sin30) + 10 = 24N

59. Option A
Let the force F along the plane
F = Fr + WSinΘ
F = UR + WSinΘ
F = UR + wSinθ (perpendicular to the plane)
R = WSinΘ (Adj)
F = U WCosΘ + WSinΘ
At the point of slipping, U = TanΘ
F = (TanΘ) WCosΘ + WSinΘ
F = WSinΘ (Cos) + WSinΘ
F = WSinΘ + WSinΘ + WSinΘ = 2WSinΘ
F = 2 x 4 10Sin30 = 40N

60. Option D
For a crate placed with co-efficient of freedom, the force acting are weight and friction
If the body is not stable under this condition, it tend to slips dominants.
Hence, an additional force opposite to the direction of motion required to be stationary. This is shown below
When stable F + Fr = WSinΘ (Resolving parallel to the plane)
F = WSinΘ – Fr = WSin0 – UR
Resolving perpendicular to the plane
R = WCosΘ
:. F = SinΘ – (UwCosΘ) = W(SinΘ – UCosΘ)
F = mg(SinΘ – UCosΘ)
F = 40 x 10 (Sin45 – 0.25Cos45) = 212N

61. Option C
At B, or highest point
It posses PE
PE = mgh = mg(100) = 100mg
PE = 100 (10)m = 1000m
At A it possesses KE before finally coming
Torest KE = ½mr2 = $½m20^2$= 200m

The percentage of initial energy converted

To KE = 200 = 20%

1000

62. Option C

For objects starting from rest with uniform acceleration,

V = at, s = ½at, r = 2as (as x = 0)

Work done = F x distance

= F x (½at)

= 40 x ½ x 0.1 x 4 = 3J

63. Option D

64. Option B

65. Option C

Work done here = Energy required in raising an object through a height

Work done = Mgh = 700 x 10 80 = 560000J

Work done = 5.6 x 10J

64. Option D

At a height PE = mgh = 10 x 10 x 20 = 100J

KE = ½mr = ½ x 10 x 9 = 5 x 81 = 405J

Total energy at that height = PE – KE

= 2000 + 405

= 2405J

65. Option C

66. Option D

KE = ½mr² = ½ x 200 x 10² = 10000

= 1 x 10⁴ J

67. Option D

Power = $\frac{\text{work done}}{\text{Time}}$ = $\frac{\text{F x Distance}}{\text{Time}}$

Power = $\frac{\text{mg x 0}}{\text{T}}$

Where S = n

Power = $\frac{(50 \times 10) \times 25}{2 \times 60}$ = 10.42W

68. Option D

P = $\frac{\text{F x Distance}}{\text{Time}}$ = mg x h

Pt = mgh :. T=$\frac{mgh}{P}$

T = $\frac{60 \times 10 \times 22}{0.25 \times 1000}$ = 52.85

69. Option B

Contact forces include Tension, Friction, Reaction, and Upthrust.

Non-contact forces are fields. These are gravitational m, magnetic and electric forces

$\frac{F \times m_1 m_2}{D}$ F = Gm_1m_2

$F = \frac{7 \times 10 \times 10\ 10^3}{1} = 7 \times 10^2 N$

Option C

73. Option D

74. Escape velocity = Ve = $\sqrt{2gR}$

= Ve = $\sqrt{2 \times 10 \times 6.4 \times 10}$

Option B

75. Escape velocity = $\frac{2PE}{m} = 2gR = \frac{2GM}{R}$

$V = \sqrt{\frac{2PE}{m}} = \frac{2 \times 3.25 \times 10}{5} = 1.1 \times 104ms-1$

76. Option B

77. Option B

Let the unstretched length be living $\frac{F}{e} = K$

$\frac{20 - 0}{14 - L} = \frac{30 - 20}{16 - 14}$

L = 10cm

78. Option A

If L is the Neutral length and $\frac{F}{e} = K$

$\frac{100 - 0}{20 - L} = \frac{200 - 100}{25 - 20}$

L = 15cm

79. Option D

Energy per unit volume = $\frac{½(Energy)}{Volume}$

As energy = Average Force x extension in Material

$E = \frac{½Force \times Distance}{Area \times Height} = \frac{½F \times e}{A \times L} = ½(stress \times stain)$

ANSWERS TO HEAT AND TEMPERATURE

1. Option B
2. Option C
3. Option A
4. Option A
5. Option E
6. Option A
7. Option E
8. Option C
9. Option E
10. Option C
11. Option A
12. Option E
13. Option D
14. Option C
15. Option C