same direction as the train is 400m away. What are the coordinates of the bird as determined by the passenger? (a) (200m,0,0,10s) (b)(350m,0,0,10s) (c)(0,0,0,0s) (d) (100,0,0, 0s)

19. The acceleration of a moving object is equal to the (a) gradient of a displacement–time graph (b) gradient of a velocity-time graph(c) area below a speed -time graph (d) area below a displacement–time graph

20. A stone dropped from a cliff fell 20m. It's velocity is(a)10m/s (b) 19m/s (c) 20m/s (d) 400m/s

21. An object is moving such that at time t=2s it is 19m from a reference point and at time t=6s it is 200m from the reference point. What will be its average velocity?(a) 45.25m/s (b) 45.25m (c) 50m/s (d) 55m/s

22. The motion of an animal is described by $x=20m+5m/s^2t^2$ what will be the displacement of theanimal from t_1= 1s to t_2=2s.(a) 40m (b) 25m (c) 5m (d) 15m

23. What will be the average velocity of the particle in **Q22** above using the assumed time interval(a) 40m/s (b) 15m/s (c) 25m/s (d)10m/s

24. A motor cyclist moving with a constant acceleration of $4m/s^2$ is 5m from a reference point at time t=0s and has a velocity of 15m/s. find his position at t=2s(a) 43m (b) 43m/s (c) 40m/s (d) 25m

25. An object is thrown upward with an initial velocity of u at an angle α to the horizontal, the time taken by the object to return to the ground will be given by

(a) $t=\frac{2u\sin\alpha}{g}$ (b) $t=\frac{4\sin\alpha}{g}$ (c) $t=\frac{u^2\sin\alpha}{g}$ (d) $t=\frac{u\sin 2\alpha}{g}$

26. If the initial velocity of a particle is 90m/s and the total time of flight is 8s,what is the angle of projection?(a) 35^0 (b) 60^0 (c) 73.3^0 (d) 63^0

27. A ball falls freely from a tower. Calculate its position after 2s.(a) 20m (b) 40m (c) 25m (d) 30m

28. What will be the velocity of the ball in **Q27** above after 5sec?(a)2m/s (b) 100m/s (c) 50m/s (d) 25m/s

29. Two cars A and B are moving with velocity V_A=10m/s and V_B=15m/s respectively. What will be the velocity of car A relative to car B?(a) 5m/s (b) -5m/s (c) -10m/s (d) -15m/s

30. Themaximum range in a projectile can be found when the angle of projection is
$(a)\ 0^0 (b)30^0 (c)45^0 (d)60^0$

31. A force of 40N acting at 30^0 to the horizontal on a body of mass 5kg resting on a smooth horizontal surface. What is the horizontal force acting on the object?(a)30N (b) 20N (c) 25N (d) 35N

32. A car of mass 1000kg is accelerating at 2 ms^{-2}. What is the resultant force acting on the car?
(a) 10000N (b)5000N (c) 2000N (d) 500N

33. A lift moves up with an acceleration of 2 ms^{-2}. Calculate the reaction of the floor on a man of mass 50kg standing in the lift.(a)600N (b) 400N (c) 800N (d) 1000N

34. A body initially at rest explodes into two pieces of mass 2M and 3M respectively having a total kinetic energy E. The kinetic energy of the piece of mass 2M after the explosion is (a) $\frac{E}{3}$ $(b)\frac{E}{5}$ $(c)\frac{2E}{5}$ $(d.)\frac{3E}{5}$

35. Starting from rest, a car of mass 1000kg accelerate steadily to $20ms^{-1}$ in 10s.what is the average power developed in the time period(a)0.2 kW (b) 20 kW (c) 15 kW (d) 10kW

36. Which of the following pairs has one scalar and one vector quantity
(a) Displacement,acceleration (b)potential energy, work (c)speed, power (d)kinetic energy, force

37. A shell of mass 50kg is projected at 60^0 to the horizontal with a speed of 200 ms^{-1} Neglecting air resistance, the kinetic energy of the shell at its maximum height is (a) 0 J (b) $1.6x10^5J$ (c) $2.0x10^5J$ (d) $2.5x10^5J$

BUK
Bayero University, Kano

DEPARTMENT OF PHYSICS

RST SEMESTER EXAMINATION — 2020/2021 SESSION

URSE: PHY1210: Mechanics — TIME ALLOWED: 2hr.

STRUCTION: Answer all questions by choosing the correct option as appropriate.

1. By using prefixes, we can write 335×10^{-8}s as (a) 3.35μs (b) 33.5μs (c) 0.335μs (d) 335μs
2. Which of the following is NOT a vector quantity? (a) acceleration (b) displacement (c)density (d) velocity.
3. Which one of the following has not been expressed in proper unit?
(a) Momentum →$Kgms^{-1}$ (b) Energy→Kgm^2s^{-3} (c) Power→Kgm^2s^{-1} (d) Pressure →$Kgm^{-2}s^{-2}$
4. A set of fundamental and derived units is known as
(a) system of units (b) CGS units (c) metric units (d) supplementary units
5. A speed of 90 km/h, expressed in cm s^{-1} is (a) 2.5 (b) 2500 (c) 9200 (d) 300
6. Which of the following is a dimensionless constant?
(a) π (b) Area (c) Specific gravity (d) Gravitational constant.
7. What is the dimension of work done? (a) MLT^{-2} (b) $ML^{-2}T^2$ (c) ML^2T^{-2} (d) ML^2T^{-1}
8. One of the following options has wrong dimension.
(a) Velocity is LT^{-1} (b) Force is MLT^{-2} (c) Surface tension is MT^{-2} (d) Work is ML^2T^{-1}

Use this information to answer questions 9, 10 and 11: In a simple pendulum experiment, it was observed that the time period 'T' of oscillation depends on length 'L', 'mass m of the body' and 'the acceleration due to gravity g'.If a mathematical relation is given by $T = k\,m^x L^y g^z$.

9. The respective values of x, y, and z are? (a) $0, \frac{1}{2}, 1$ (b) $0, \frac{1}{2}, -\frac{1}{2}$, (c) $\frac{1}{2}, -\frac{1}{2}, 0$ (d) $0, \frac{1}{2}, 0$
10. If the quantity is dimensionless, what are the values of x, y and z?
(a) x =y=z=1 (b) x = y = z = 0 (c) x =y=1 z=0 (d) x + y+ z = 1
11. ---------- is the mathematical expression of the relation. (a) $T = kl\sqrt{g}$, (b) $k\sqrt{\frac{l}{g}}$, (c) $k\sqrt{\frac{g}{l}}$, (d) $k\sqrt{\frac{m}{l}}$
12. ---------- is needed for the experimental verification of various theories.
(a) unit (b) dimensionally analysis (c) instrument (d) measurement
13. Two forces acting at a point are represented both in magnitude and direction by the adjacent side of parallelogram.This is a statement of (a) Newton's law of vectors (b) Dalton's law of forces
(c) Triangular law of forces (d) parallelogram law of forces
14. Checking the correctness of physical quantities using the method of dimensions is based on
(a) Equality of inertia frame of reference (b) the type of system of units (c) the method of measurement
(d) principle of homogeneity of dimensions

Use this information to answer questions 15&16: Given two vectors $\vec{A} = -\hat{\imath} - \hat{\jmath}$ and $\vec{B} = 3\hat{\imath} + 2\hat{k}$.

15. What is the value of $\vec{A} \cdot \vec{B}$? (a) 3 (b) -3 (c) 2 (d) -2 (e) 5
16. Simplify $2\vec{A} - \vec{B}$(a) $-5\hat{\imath} - 2\hat{\jmath} + \hat{k}$ (b) $5\hat{\imath} - 2\hat{\jmath} - 2\hat{k}$ (c) $-3\hat{\imath}$ (d) $-5\hat{\imath} - 2\hat{\jmath} - 2\hat{k}$.
17. Constant error can be caused due to (a) faulty construction of instrument (b) wrong setting of instrument
(c) wrong procedure of handling the instrument (d) lack of concentration of observer.
18. A passenger in a train moving at 5m/s passes man standing on a station plat form at $t=t^1=0$. Ten seconds after the train passes him, the man on the platform determines that a bird flying along the tracks in the

29. What is the work done in Joules (J) in assemble the three charges ? (a) 5×10^{8}J(b)-6 x 10^{9}J(c)-6 x 10^{9}J (d) 7×10^{9}J(e) none of the above

30 What is electric potential at point ***P*** in the absent of charge q_3?(a) 1.4×10^{10} V (b) -6×10^{11} V (c)6×10^{11}V (d)-1.4×10^{10}V (e) none of the above

31 When anelectric field***E*** is parallel to an area **A**, the electric flux through the area will be(a) maximum (b) 0 (c) minimum(d)b & c (e) none of the above

32 A point charge is a charge body whose size is small compared to a (a) displacement(b) distance (c) force(d) speed (e) all of the above

33 The net charge in the charging by induction method is always (a) 1 (b) infinity(c)0 (d) 1C(e) maximum

34 The instrument used to detect the presence and nature of electric charge on a body is called (a)electroscope (b) induction coil(c)electrometer(d) galvanometer (e) plumb-line

The instrument used to measure the magnitude of electric charge on a body quantitatively is called (a)electroscope (b) induction coil(c) electrometer (d) galvanometer (e) ammeter

35. What must be the magnitude of electric field for a particle of charge 2μC and mass 0.3kg to be levitated? (a) 2×10^{8}N/C (b)4×10^{7}N/C (c) 5×10^{11}N/C (d) 1×10^{9}N/C (e) none of the above

36. An electric field of 10N/C passes through a surface area of $8m^2$ to produce an electric flux of $80Nm^2$. The angle between the electric field and the surface area is (a)30^0(b) 45^0(c) 0^0(d)90^0 (e)15^0

37. The electric field strength between two points separated by 40m apart is 0.5N/C. The potential difference across them is (a) 40V (b) 20V (c) 80V (d) 0.0013V (e) none of the above

38. 0.0005J of energy is the same as (a) $0.0005eV$(b)$2 \times 10^{23}eV$(c)$2 \times 10^{17}eV$ (d)$3 \times 10^{15}eV$(e)$5000eV$

39. 3pC of charge will have ------ electrons (a)2×10^{7} (b) 3×10^{9}(c)2×10^{6} (d) 7×10^{9} (e) 2×10^{19}

40. The mass of 2nC of charge is (a) $2 \times 10^{-20}kg$ (b) $1 \times 10^{-20}kg$ (c) $3 \times 10^{-19}kg$(d)$3 \times 10^{-23}kg$ (e) $0.03g$

41. Two identical charges repel each other with a force of 4N. If the distance between the charges is halved, force will be (a) 1N (b) 2N (c) 8N (d) 16N (e) none of the above

42. Two like charges of the same magnitude are 3.0 mm apart. If the force of repulsion they exert upon each ot is 3.0 N, what is the magnitude of each charge? (a) 3.0×10^{3}C (b) 5.5×10^{-2}C (c) 5.5×10^{-8}C (d) 5.5×10^{-5}C none of the above

43. The electric field intensity at a point situated 4 meters from a point charge is 200N/C. If the distance is redu to 2 meters, the field intensity will be (a) 400N/C (b) 600N/C (c) 800N/C (d) 200n/c (e) none of the above

44. The direction of the electric field intensity is (a) away from a negative charge(b) towards a negative charg towards a positive charge(d) none of the above (e) from infinity to a negative charge

45. The nature of a test charge is (a) positive (b) negative (c) neutral(d) none of the above(e) opposite

46. Electric field lines can never (a) interchange(b) intersect (c) exchange (d) none of the above (e) go to infini

47. The electric flux through any closed surface depends upon(a) shape of the surface (b) area of the surface charge only(d) permeability (e) none of the above

48. What is the electric potential energy of two charges +3μC and -3μC separated by 0.002m apart in vacuum? 9J (b) -20250J (c)20250J (d)-41J (e) 41J

49. The SI unit of dipole moment is (a) Nm^2/C (b) kgC (c) NC (d) Nm(e)none of the above

50. Insulator material which is placed between the two plates of a capacitor is called (a) electric (b) resistor (c) dielectric (d) inductor (e) Plasma

51. Electric force between two unlike charges is similar to gravitational force between (a) two point charg (b) two point masses (c) two bodies (d) two distances (e) Zero Changes

52. The electric potential at a point due to a charge of $100\mu C$ at a distance of 9m is (a) 231kV (b) 700V (c) 200kV (d) 100kV

53. Given the network of capacitors in series with C_1= 12 μF, C_2=8 μF, C_3= 24 μF, what is the effective capacitance: (a) 0.4 μF (b) 8 μF (c) 4 μF (d) 40 μF

54. In the expression, U= $\frac{1}{2}QV$,...(a) Potential energy stored in a capacitor (b) electric field energy (c) ene stored in capacitor (d) electric energy density

BAYERO UNIVERSITY, KANO
COLLEGE OF NATURAL AND PHARMACEUTICAL SCIENCES
(FACULTY OF PHYSICAL SCIENCES)
DEPARTMENT OF PHYSICS
2020/2021 SESSION – FIRST SEMESTER EXAMINATIONS

PHY1210 (Mechanics) – *Faculty of Agriculture* **TIME:** 2hrs

INSTRUCTION: Answer ***all*** questions **DATE:** 02nd March, 2021

Useful Constants: $G = 6.67 \times 10^{-11} Nm^2kg^{-2}$, $g = 9.8ms^{-2}, m_e = 6.0 \times 10^{24} Kg$, $r_e = 6.4 \times 10^6 m$

1. When an object is moving with uniform velocity, what is its acceleration? (a) zero (b) uniform (c) non-uniform (d) negative
2. Work done has a dimension of (a) MLT^{-2} (b) $ML^{-2}T^2$ (c) $ML^{-1}T^{-1}$ (d) ML^2T^{-2}
3. What is the smallest distance, in meters, needed for an airplane touching the runway with a velocity of 100m/s and an acceleration of -10 m/s^2 to come to rest? (a) 300m (b) 400m (c) 500m (d) 600m
4. A coin is dropped in a vacuum tube; find the coin's velocity after 0.30 seconds. (a) 1m/s (b) 3m/s (c) 4m/s (d) 5m/s

Use this information to answer question 5 – 7. A uniform disc of mass $20kg$ and radius $0.15m$, stating from rest rotates with a uniform angular acceleration of $0.7rad^{-2}$ about an axis through its center.

5. What is its moment of inertia? (a) $0.450kgm^2$ (b) $0.150kgm^2$ (c) $0.225kgm^2$ (d) $0.180kgm^2$
6. What is its angular velocity after 10s? (a) $0.7\ rads^{-1}$ (b) $7.0\ rads^{-1}$ (c) $0.5rads^{-1}$ (d) $0.1rads^{-1}$
7. Its kinetic energy after 10s is? (a) $0.06J$ (b) $5.3J$ (c) $0.03J$ (d) $11.01\ J$

Use this information to answer question 8 – 10. The motion of a particle along a straight line is described by the function $x = 9t^2 - 12t + 4$. x is in meters (m) and time t in seconds(s).

8. From time t =0 to t = 1s, the particle will have a displacement of (a) 3m (b) -2m (c) 2m (d) -3m
9. What is the velocity of the particle at time $t = 0$? (a) 12m/s (b) -12m/s (c) 9m/s (d) -9m/s
10. What is the acceleration of the particle at any time t? (a) 9 (b) 9t + 9 (c) -12 (d) 18t
11. Find angle θ when two forces $(P + Q)$ and $(P - Q)$ act to produce a resultant force of $\sqrt{3P^2 + Q^2}$. (a) 30° (b) 45° (c) 60° (d) 90°
12. A body starts its motion with zero velocity and its acceleration is 3m/s^2. Find the distance travelled by it in fifth second. (a) 56.2m (b) 17.5m (c) 37.5m (d) 14.5m
13. An object dropped on planet X falls 64m in 4 seconds. Find the acceleration due to gravity on planet X. (a) 1.6m/s^2 (b) 10m/s^2 (c) 8m/s^2 (d) 7m/s^2
14. A projectile starting from ground hits a target on the ground located at a distance of 1000 meters after 40 seconds. What is the size of the angle θ? (a) 82.7^0 (b) 33.3^0 (c) 6.6^0 (d) 45.5^0
15. Magnitude of displacement from initial position to final position is a (a) curved line (b) straight line (c) circle (d) total distance
16. An aircraft takes off from Aminu Kano International Airport, Kano on the axis of $x = 1.25t^2$ and $y = 0.03t^3$, where t is the time after take-off, measured in seconds, x and y are given in meters. At $t = 40s$, what is the speed at the instant it starts to lift up? (a) 32.9 ms^{-1} (b) 100.0 ms^{-1} (c) 144.0 ms^{-1} (d) 175.0 ms^{-1}
17. Range of projectile will be maximum if angle of projectile is (a) 45^0 (b) 30^0 (c) 60^0 (d) 0^0
18. A feather is dropped on the moon from a height of 1.40 meters. The acceleration of gravity on the moon is 1.67 m/s^2. Determine the time for the feather to fall to the surface of the moon. (a) 1.29s (b) 1.87s (c) 0.5s (d) 2.0s

19. A kangaroo is capable of jumping to a height of 2.62 m. Determine the takeoff speed of the kangaroo 42.
(a)6.0 m/s (b) 7.24m/s (c) 9 m/s (d) 5.03 m/s

20. The gravitational potential energy can be expressed as? (a) $\frac{GmM}{r^2}$ (b) $\frac{GmM}{r}$ (c) $\frac{Gm^2}{r^2}$ (d) $\frac{GM}{r^2}$

21. The rate of work done can be termed as? (a) Impulse (b) work (c) Power (d) Energy

Use this information to answer questions 22 – 25. A ball is hit such that it starts with a velocity of $50\ m/s$ at angle of 50^o to the horizontal.

22. What is the maximum height reached by the ball? (a) $3.8\ m$ $(b)146.7\ m$ (c) $73.4\ m$ $(d)375\ m$
23. What is the time taken to reach the maximum height? (a) 7.7 sec (b) 73.4 sec (c) 3.8 sec (d) $146.7\ sec$
24. What is the time taken to reach the ground? (a) 146.7 sec (b) 7.7 sec (c) 73.4 sec (d) $3.8\ sec$
25. What is the horizontal distance travelled? (a) $1000\ m$ (b) $246\ m$ (c) $866\ m$ (d) $433\ m$
26. Retardation is (a) zero acceleration (b) negative acceleration (c) uniform acceleration (d) variable acceleration
27. A 10 kg body has an acceleration of 5 m/s^2. What is the net force acting on it? (a) 72N (b) 50N (c) 20N (d) 21N

Use this information to answer question 28 – 29. A force of 3000N is applied to a 1500kg car at rest.

28. What is its acceleration? (a) $2m/s^2$ (b) $4m/s^2$ (c) $2.7\ m/s^2$ (d) $3.3\ m/s^2$
29. What will be its velocity 5 second after? (a) 8s (b) 7s (c) 10s (d) 9s

Use this information to answer questions 30 – 33. A ball is hit such that it starts with a velocity of $50\ m/s$ at angle of 50^o to the horizontal.

30. What is the maximum height reached by the ball? (a) $3.8\ m$ $(b)73.4\ m$ (c) $146.7\ m$ $(d)375\ m$
31. What is the time taken to reach the maximum height? (a) $3.8\ s$ (b) $7.7\ s$ (c) $73.4\ s$ (d) $146.7\ s$
32. What is the time of flight? (a) $3.8\ s$ (b) $4.9\ s$ (c) $5.3\ s$ (d) $7.66\ s$
33. What is the horizontal distance travelled? (a) $100\ m$ (b) $146\ m$ (c) $166\ m$ (d) $246\ m$
34. A person is holding a bucket by applying a force of 10N. He moves a horizontal distance of 5m and then climbs up a vertical distance of 10m. Find the total work done by him(a) 50J (b) 150J (c) 800J (d) 100J
35. According to the conservation of momentum, the momentum before a collision should be -----momentum after a collision.(a) twice the original momentum of the object's (b) greater than the (c) the same as the(d) less than the
36. What is the kinetic energy of a body of mass 100kg moving with a speed of 3 m/s. (a) 450J (b) 200J (c) 234J (d) 243J

$\frac{1}{2}mv^2$

37. The change in momentum is 1.52 Ns for a ball that strikes the floor for 0.015s. Find the force applied to the ball.(a) 101 N (b) 320 N (c) 85 N (d) 33 N
38. Which object has the greatest momentum? (a) An 18-wheeler tractor trailer at rest.(b) An average mass person walking (c) A baseball thrown by a professional pitch (d) A sports car driving on the highway
39. if 2 objects collide and stick together, what will happen to their velocities? (a) velocities will increase(b)velocities will decrease (c) velocities will stay the same (d) none of the options
40. Two fat ladies, one with a mass of 89.3 kg and the other with a mass of 94.8 kg, are running at a velocity of 8.32 m/s. If they are both headed in the same direction, what is the total momentum?(a) 789 Ns (b) 743 Ns (c) 184 Ns (d) 1532 Ns
41. Body A of mass 20kg moving with a velocity of 6m/s collides with another body B of mass 10kg moving with velocity of 3 m/s. if body A moves with a velocity of 4 m/s after collision, calculate the velocity of body B. (a) 10.1m/s (b) 8.8 m/s (c) 7.0 m/s (d) 9.0 m/s

74.3.916

$v=u+gt$

42. A $5\,Kg$ body moving at $15\,m/s$ collides head on with a $10\,Kg$ body moving in the opposite direction at $30\,m/s$. What is the velocity of the $5\,Kg$ mass body after the collision? (a) $15\,m/s$ (b) $10\,m/s$ (c) $5\,m/s$ (d) $8\,m/s$

43. As body rolls down, its gravitational energy changes to (a) linear kinetic energy (b) rotational potential energy (c) linear kinetic energy(d) rotational kinetic energy

44. For perfectly elastic collision, coefficient of restitution is? (a) $e = 1$ (b) $e = 0$ (c) $e = -1$ (d) $e = ½$

45. The expression of kinetic energy in terms of angular speed is? (a) $\frac{1}{2}mr^2\omega^2$ (b) $\frac{1}{2}mr\omega^2$ (c) $\frac{1}{2}mr^2\omega$ (d) $\frac{1}{2}mr\omega$

46. An object rotates with a period of 10s. How many revolutions will it make in 25 s? (a) 10 (b) 15 (c) 5 (d) 2.5

47. Moment of inertia I can be expressed as? (a) $\sum mr^2$ (b) $I = \sum mv^2$ (c) $I = \sum m^2 r$ (d) $I = \sum m^2 v$

48. Force that keeps objects in circular path is called (a) centrifugal force(b) frictional force (c) centripetal force (d) inertia

49. An object that moves in uniform circular motion has a centripetal acceleration of 13 m/s^2. If the radius of the motion is 0.02 m, what is the period of the motion? (a) 0.25s (b) 3s (c) 1.4s (d) 0.03s

Use this information to answer questions 50 - 51. A body of mass 4kg travelling with a velocity of 50 m/s collides with another body of mass 30kg travelling with a velocity of 30 m/s in the opposite direction. After impact the smaller body moves with a velocity of 10m/s.

50. What is the velocity of the bigger mass after collision, If they all move in the same direction?
(a) -27.1m/s (b) 28.0 m/s (c) 25.7 m/s (d) -24.7 m/s

51. What will be the Loss kinetic energy due to impact? (a) 5400J (b) 4200J (c) 5000J (d) 4803J

Use this information to answer question 52 - 53. A body A moving with a velocity of $300\,m/s$ collides with a body B of the same mass at rest.

52. The final velocity of body A is? (a) $0\,m/s$ (b) $150\,m/s$ (c) $100\,m/s$ (d) $300\,m/s$

53. The final velocity of body B is ? (a) $150\,m/s$ (b) $300\,m/s$ (c) $100\,m/s$ (d) $0\,m/s$

54. An object has a weight of 12N on the Earth. It is placed on the moon, where gravity is 1.67m/s^2. What is its weight on the moon? (a) 10N (b) 72N (c) 2N (d) 18 N

55. The moon and other satellites rotate around the earth. Identify the force that keeps these satellites in orbit.
(a) electrostatic force (b) friction (c) gravitational force (d) electromagnetic force

Use this information to answer questions 56 - 57. A plane has a takeoff speed of 88.3 m/s and requires 1365 m to reach that speed.

56. Determine the acceleration of the plane. (a) 5.7 m/s^2 (b) 1.8 m/s^2 (c) 4.0 m/s^2 (d) 1.0 m/s^2

57. The time required to reach this speed. (a) 15.5s (b) 31.9s (c) 34s (d) 45s

Use this information to answer questions 58 - 59. A plane has a takeoff speed of 88.3 m/s and requires 1365 m to reach that speed.

58. Determine the acceleration of the plane. (a) 5.7 m/s^2 (b) 6.8 m/s^2 (c) 7.0 m/s^2 (d) 10.0 m/s^2 — 2.85m/s^2

59. The time required to reach this speed. (a) 15.5s (b) 31.9s (c) 34s (d) 45s

60. In collision of particles, the factor called coefficient of restitution (e) can be expressed as?
(a) $\frac{V_2 - V_1}{u_2 - u_1}$ (b) $\frac{V_2 - V_1}{u_1 - u_2}$ (c) $-\frac{V_2 - V_1}{V_2}$ (d) $\frac{V_2}{u_2 - u_1}$

BAYERO UNIVERSITY, KANO
(FACULTY OF SCIENCE)
DEPARTMENT OF PHYSICS
2016/2017 SESSION – FIRST SEMESTER EXAMINATIONS

COURSE: PHY1210 (Mechanics) – *For Faculty of Science Students Only*

INSTRUCTION: Answer *all* questions. $g=9.8 m/s^2$ $G = 6.67 \times 10^{-11} Nm^2kg^{-2}$

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1. A student conducted an experiment and takes 100 readings. He repeat the experiment and takes 800 readings, h doing so the probability of error (a) Become four times (b) is halve (c) is reduced by $\frac{1}{8}$ factor (d) remain uncharged
2. The time dependence of a physical quantity Q a given by $Q = Q_o \exp(-\beta t^2)$, where β is a constant and t is th time. The constant β (a) has the dimension L (b) has the dimension of $\lambda^2 T^{-2}$ (c) is dimensionless (d) has th dimension of T^{-2}
3. Which of the following is the smallest one in magnitude (a) One meter (b) One millimetre (c) one Fermi (d) or angstrom unit

Use this information to answer questions 4 and 5. A physical quantity has dimension of the form $L^x M^y T^z$.

4. If the quantity is dimensionless, what are the values of x, y and z? (a) x =y=z=1 (b) x = y = z = 0 (c) x =y=1 z=0 (c x + y+ z = 1
5. When y = 0, x = 1 and y = -2, the quantity will be for? (a) Density (b) Speed (c) Force (d) Acceleration
6. What is the dimension of force per unit time? (a)M L T^{-2} (b) M L T^{-3} (c). $L^2 T^{-1}$ (d) M L^{-2}
7. The period of revolution of a parking orbit around the earth is always? (a) 30 days (b)1 year (c) 24 hours (d) 3600
8. A particle moving along the x-axis has a potential energy function given by $U(x) = ax^2 + xb$ where a and b a constants, x is in metres and $U(x)$ is in joules. At what point is the particle in equilibrium? (a) $x = -\frac{b}{2a}$ (b $x = \frac{a}{2b}$ (c) $x = a - 2b$ (d) $x = \frac{2b}{a}$
9. Power is defined as : (a) $P = FV$ (b) $P = \vec{F} \times \vec{V}$ (c) $P = \vec{E}.t$ (d) $P = Fx$
10. A body moves with velocity $\vec{V} = 5\hat{\imath} + 2\hat{\jmath} - 3\hat{k}$ under the influence of a constant force $\vec{F} = 4\hat{\imath} + 3\hat{\jmath} - 2\hat{k}$ Determine the instantaneous power. (a) *67 W* (b) *32 W* (c) *100 W* (d) *15 W*
11. What power is necessary to drive a *1200 Kg* automobile up a *10%* grade (i.e one rising *10 m* vertically for every *100 m* horizontal distance), assuming a retarding force of 1000 N from friction and wind resistance? (a) *1.8K W* (b) *8.1K W* (c) *2.8K W* (d) *1.5K W*
12. Find the force of gravity between two lead balls of masses m_1=20kg and m_2= 40kg, if the distance of separation i 10cm (a) 5.34×10^{-6}N (b) 1.21×10^{-6}N (c) 3×10^{-6}N (d) 7.5×10^{-6}N
13. Express the equation of an acceleration of an object immediately after it is dropped from a height above the earth' surface as (a) $a = \frac{rR_e^2}{g}$ (b) $a = \frac{r^2R_e^2}{g}$ (c) $a = \frac{gR_e^2}{r^2}$ (d) $a = \frac{gR_e^2}{r}$
14. At what altitude above the earth's surface would the acceleration due to gravity be 4.9m/s^2? Assume that the mea radius of the earth is 6.4×10^6m and g = 9.8m/s^2. (a) 9.05×10^6m (b) 2.65×10^6m (c) 4.9×10^6 (d) 4.01×10^{14}m
15. Gravitational potential energy is given by the expression (a) $-\frac{GmM_e}{r^2}$ (b) $-\frac{GmM_e}{r}$ (c) $\frac{GmM_e}{r^2}$ (d) $\frac{GmM_e}{r}$
16. Assume that the earth revolves around the sun in a circular orbit of radius 1.49×10^8km and has a period of 365.25day. Determine the gravitational force between the sun and the earth if the mass of the earth is 5.98×10^{24}kg (a). 5.91×10^{-3}N (b). 2.97×10^{14}N (c). 3.156×10^{17}N (d) 3.53×10^{22}N
17. Torque ..... (a) is a force (b) cause angular accelerations of Objects (c) Causes transitional acceleration of Object (d) a and b
18. In rotational dynamics , an object in rotation tends to remain in rotation (a) unless acted upon by a net externa celebration torque (b) has acceleration that is directly proportional to the net force acting on it (c) has acceleratio inversely proportional to the mass (d) All of the options
19. A heavy flywheel of moment of inertia 0.3kgm^2 is mounted on a horizontal axis of radius 0.01m of negligible mas compared to the flywheel. Neglecting friction, if a force of 40N is applied tangentially to the axle, the angula acceleration is (a)13rads/s^2 (b) 1.3 rads/s^2 (c) 0.13 rads/s^2 (d) 130 rads/s^2

Using the same flywheel in 19 : The angular velocity after 10 s is (a) 133 rads/s (b) 13 rads/s (c) 0.13 rads/s (d) 1.3 rads/s

$Q = U = LT^{-1} = LT^{-2}$

$F = ma$

$F = MLT^{-2}$

$\frac{\text{Force}}{\text{Time}} = \frac{MLT^{-2}}{T} = MLT^{-3}$

20 The moment of inertia of a wheel about its axis of rotation is 0.1kgm^2. It is set to rotate by applying a tangential force of 20N with a rope wound around its circumference. If the radius of the wheel is 0.1 m, the angular acceleration of the wheel is (a)20 rads/s^2 (B) 0.002 rads/s^2 (c) 0.02 rads/s^2 (c) 2.0 rads/s^2

(a) Suppose a wheel of moment of inertia 2 kgm^2 is spinning with an angular velocity of 15 rads/s^2. If it is brought to rest by a steady breaking torque in 5s, the value of the torque is (a) 0.6 Nm (b) 0.06 Nm (c) 6 Nm (d) 60 Nm

21. The conservation of angular momentum (a)Corresponds to the conservation of linear momentum (b) States that the angular momentum about an axis of a given rotating body or system of bodies is constant if there is no external torque about the axis (c) A and B (d) None of the options.

22. A 30kg mass falls from a height of 4m. The momentum of the mass just before it hits the ground is (a) 120.0 kg m/s (b) 187.8 kg m/s (c) 320.0 kg m/s (d) 442.4 kg m/s

23. A 4.00 kg ball is traveling at 5.00 m/s and strikes a wall. The 4.00 kg ball bounces off the wall with a velocity of 4.0 m/s. The change in momentum of the ball is (a) 8. kg m/s (b) 36 kg m/s (c) 26 kg m/s (d) 45 kg m/s

24. A heavy truck has more momentum than a passenger car moving at the same speed because the truck (a) has greater mass (b) has greater speed (c) is not streamlined (d) has a large wheelbase

25. The sum of two vectors A and B lying in the xy plane and given by A =(2.0i+2.0j) m and B=(2.0i -4.0j) is :

(a) $R = 45, \theta = 333^\circ$ (b) $R = 4.5, \theta = 33^\circ$ (c) $R = 4.3, \theta = 330^\circ$ (d) $R = 4.5, \theta = 330^\circ$

26. A vector A has x, y, and z components of 8.00, 12.0, and -4.00 units, respectively. A vector expression for A in unit-vector notation is: (a) $A = \frac{8}{20}i + \frac{12}{20}j - \frac{4}{20}k$ (b) $A = \frac{8}{15}i + \frac{12}{15}j - \frac{4}{15}k$ (c) $A = \frac{8}{15}i + \frac{12}{15}j + \frac{4}{15}k$ (d) $A = \frac{8}{25}i + \frac{12}{25}j + \frac{4}{25}k$

27. A particle undergoes the following consecutive displacements: 3.50 m south, 8.20 m northeast, and 15.0 m west. What is the resultant displacement? (a) $R = 4.5, \theta = -14$ (b) $R = 9.5, \theta = -14$ (c) $R = 9.5, \theta = 330$ (d) $R = 4.5, \theta = 330$

28. A football quarterback runs 15.0 m straight down the playing field in 2.50 s. He is then hit and pushed 3.00 m straight backward in 1.75 s. He breaks the tackle and runs straight forward another 21.0 m in 5.20 s. Calculate his average velocity for the entire motion.
(a) 4.11 m/s (b) -3.15 m/s (c) 4.11 m/s (d)3.5 m/s

29. A particle is moving with a velocity of 60.0 m/s in the positive x direction at t =0. Between t = 0 and t =15.0 s, the velocity decreases uniformly to zero. What is the acceleration? (a) -4.0 m/s^2. (b) 4.0 m/s^2. (c) 40 m/s^2. (d) -40 m/s^2.

30. A 50.0-g super ball travelling at 25.0 m/s bounces off a brick wall and rebounds at 22.0 m/s. A high-speed camera records this event. If the ball is in contact with the wall for 3.50 ms, what is the magnitude of the average acceleration of the ball during this time interval? (a) 875.14 m/s^2. (b) 1.34x 10^4 m/s^2. (c) -875.14 m/s^2. (d) -1.34 x 10^4 m/s^2.

31. How many revolutions per minute must a circular, rotating space station of radius 1500m rotate to produce an artificial gravity of 9.8m/s^2? (a)0.67rpm (b) 0.77rpm (c) 0.87rpm (d) 0.97rpm

32. As body rolls down its gravitational energy changes to (a) rotational kinetic energy (b) rotational potential energy (c) linear kinetic energy (d) linear potential energy

33. Body having weight 50 kg turning in a circle at 5 ms^{-1}, if radius of circle is 5 m, then force exerted on body to hold it in circular path is (a) 200 N (b) 250 N (c) 300 N (d) 350 N

34. A car moves around a circular path of a constant radius at a constant speed. Which of the following statements is true? (a) The car's velocity is constant (b) The car's acceleration is constant (c) The car's velocity is directed toward the centre (d)The car's acceleration is directed toward the centre

35. A pilot performs a vertical manoeuvre around a circle with a radius R. When the airplane is at the lowest point of the circle pilot's weight is 4 mg. What is the velocity at the lowest point? (a) $\sqrt{Rg}$ (b) $\sqrt{2Rg}$ (c) $\sqrt{3Rg}$ (d) $\sqrt{4Rg}$

36. An object rotates with a period of 0.8s. What is the frequency of rotations? (a)1.50 Hz (b) 1.25 Hz (c) 2.50 Hz (d) 2.50 Hz

BAYERO UNIVERSITY, KANO
COLLEGE OF NATURAL AND PHARMACEUTICAL SCIENCES
(FACULTY OF PHYSICAL SCIENCES)
DEPARTMENT OF PHYSICS
2018/2019 SESSION – FIRST SEMESTER EXAMINATIONS

PHY1210 (Mechanics) – *Faculty of Computer Science and Information Technology*

INSTRUCTION: Answer *all* questions TIME: 2hrs

Useful Constants: $G = 6.67 \times 10^{-11} Nm^2kg^{-2}$, $g = 9.8ms^{-2}$

1. When an object is moving with uniform velocity, what is its acceleration? (a) zero (b) uniform (c) non-uniform (d) negative (e) undefined
2. Work done has a dimension of (a) MLT^{-2} (b) $ML^{-2}T^2$ (c) $ML^{-1}T^{-1}$ (d) ML^2T^{-2} (e) MLT
3. What is the smallest distance, in meters, needed for an airplane touching the runway with a velocity of 100m/s and an acceleration of -10 m/s^2 to come to rest? (a) 300m (b) 400m (c) 500m (d) 600m (e) 60m
4. A coin is dropped in a vacuum tube, find the coin's velocity after 0.30 seconds. (a) 1m/s (b) 3m/s (c) 4m/s (d) 5m/s (e) 6m/s
5. A branch of physics dealing with motion without considering its causes is known as (a) Kinematics (b) Dynamics (c) Hydrodynamics (d) Mechanics (e) Aerodynamics
6. A rocket is fired vertically upward with an initial velocity of 29 m/s. Find the rocket's maximum altitude. (a) 36m (b) 10m (c) 43m (d) 25m (e) 52m
7. At a particular instant, acceleration of a body is called (a) instantaneous acceleration (b) instantaneous velocity (c) instantaneous displacement (d) instantaneous speed (e) uniform acceleration

The motion of a particle along a straight line is described by the function $x = 9t^2 - 12t + 4$. x is in meters (m) and time t in seconds(s). Use this information to answer questions *8* to *10*.

8. From time t =0 to t = 1s, the particle will have a displacement of (a) 3m (b) -2m (c) 2m (d) -3m (e) 4m
9. What is the velocity of the particle at time, = 0 ? (a) 12m/s (b) -12m/s (c) 9m/s (d) -9m/s (e) 0 m/s
10. What is the acceleration of the particle at any time t? (a) 9 (b) 9t + 9 (c) -12 (d) 18t (e) 12t
11. Study of motion of objects, its causes and effects is called (a) heat (b) mechanics (c) atomic physics (d) plasma physics (e) geophysics
12. A body starts its motion with zero velocity and its acceleration is 3m/s^2. Find the distance travelled by it in the fifth second. (a) 56.2m (b) 17.5m (c) 37.5m (d) 14.5m (e) 2.08m
13. An object dropped on planet X falls 64m in 4 seconds. Find the acceleration due to gravity on planet X. (a) 1.6 m/s^2 (b) 10m/s^2 (c) 8 m/s^2 (d) 7 m/s^2 (e) 5.7m/s^2
14. A projectile starting from ground hits a target on the ground located at a distance of 1000 meters after 40 seconds. What is the size of the angle θ? (a) 82.7^0 (b) 33.3^0 (c) 6.6^0 (d) 45.5^0 (e) 60.9^0
15. The path traced out by a projectile is called its (a) velocity (b) density (c) speed (d) trace (e) none of the options
16. ML^{-3} represents the dimension of (a) pressure (b) density (c) momentum (d) frequency (e) surface tension
17. Range of projectile will be maximum if angle of projectile is (a) 45^0 (b) 30^0 (c) 60^0 (d) 0^0 (e) 90^0
18. A boy on a bicycle decreases his velocity from 5m/s to 20m/s in 10 seconds. What is the acceleration of the bicycle? (a) -3.1 m/s^2 (b) 4.6m/s^2 (c) -4.6 m/s^2 (d) 1.5 m/s^2 (e) -1.5m/s^2
19. A car is moving with speed 30m/s. Due to application of brakes it travels 30m before stopping. Find its acceleration. (a) -30 m/s^2 (b) 15m/s^2 (c) -5m/s^2 (d) 5m/s^2 (e) none of the options
20. Which of the following is a dimensionless constant? (a) π (b) Area (c) Specific gravity (d) Gravitational constant (e) density
21. A speed of 90 km/h, expressed in cm s^{-1} is (a) 2.5 (b) 300 (c) 90 (d) 2500 (e) 3502

An object is launched at a velocity of 20 m/s in a direction making an angle of 25° upward with the horizontal. Use this information to answer questions *22* to *24*.

22. At what time interval will the objects touches the ground after it has been launched? (a) 5.2s (b) 2.5s (c) 1.7s

37. An object travels in a circular path of radius r at a constant speed v. What happens to the object's acceleration if the speed is doubled and the radius stays unchanged? (a) It doubles (b) It quadruples (c) It is cut to a half (d) It stay unchanged

38. The expression for the density of the earth is given by? $(a)\rho = \frac{volume}{Mass}$ $(b)\rho = \frac{4G\pi r}{3g}$ $(c)\rho = \frac{3g}{4\pi rG}$ (d) *all of the above*

39. Given two vectors $\vec{A} = 2i - j + k$ and $\vec{B} = i + 2j - k$. Evaluate $2\vec{A} + \vec{B}$ (a) $5i - j$ (b) $i + 5j - k$ (c) $5i + k$ (d) $k - 5i$

40. A change in momentum may result from (a) an acceleration (b) a force (c) an impulse (d) all of the above

Use this information to answer question 41 and 42. The distance x move by a car at any time t is given by $x = t^2 + 9t - 320$. x is in meter (m) and t is in seconds (s).

41. How far is the car after 1 minute? (a) 5.4km (b) 1.4km (c) 3.8km (d) 160m
42. With what velocity will the car move after 20s? a) 6km/h b) 49m/s c) 3m/s d) 30m/s
43. The dimension of work is...? (a) ML^2T^{-2} (b) ML^2T^2 (c) M^2LT^{-2} (d) ML^2T^{-1}
44. If two cars A and B, with velocities V_A =10m/s and V_B =15m/s respectively, and car B is moving in opposite direction to A. What is the relative velocity of A in relation to B (V_{AB})? (a) -5m/s (b) 5m/s (c) -25m/s (d) 25m/s
45. A 4.00 kg ball is moving at 4.0 m/s to the right and a 6.00 kg ball is moving at 3.00 m/s to the left. The total momentum of the system is (a) 16 kg m/s to the right (b) 2.0 kg m/s to the right (c) 2.0 kg m/s to the left (d) 18 kg m/s to the left.
46. A car accelerates from rest to a speed of 10m/s in 8secs. How far will it travel during this time? (a) 25m (b) 35m (c) 30m (d) 40m
47. A 0.14g baseball with a velocity of 25.0 m/s is hit by a baseball bat and leaves at 30.0 m/s in the opposite direction. If the ball was in contact with the bat for 12.0 ms, what is the average force on the ball? (a) 750 N (b) 642 N (c) 550 N (d) 482 N

Use this information to answer question Q48 and Q49: A ball is lifted with an initial velocity of 20m/s at an angle of 40°

48. ..... is the position of the ball along x-axis after 2sec. (a) 10.86m (b) 30.64m (c) 16.88m (d) 13.34m
49. The time taken for the ball to reach the maximum height is....? (a) 0.76s (b) 1.31s (c) 2.52s
50. ____ is the velocity with which a projectile need to escape from the earth of radius 6.4 X 10^6m. a) 11.2km/s b) 13.3km/s c) 14.4 km/s d) 15.5km/s.
51. One of the following is not the unit of work? a) kgm/s b) Nm c) kgm^2/s^2 d) kgm^2s^{-2}
52. A flea has a mass of $4.5 \times 10^{-7} kg$ and can jump vertically upwards to a height of 6 cm. Calculate the kinetic energy of the flea as it leaves the ground . (a) $2.65 \times 10^{-7} J$ (b) $3.25 \times 10^{17} J$ (c) $1.95 \times 10^{-17} J$ (d) 1.09 J
53. The minimum power needed to lift an object of 20kg with speed of 20m/s. a) 3920kgm^2s^{-1} b) 720kgm^2s^{-3} c) 120kgm^1s^{-3} d) 120kgm^2s^1
54. ____ is the mathematical expression for parallel axis theorem. a) $I = I_{cm} + Md^2$ b) $I = Md^2$ c) $I = I_x + I_y$ d) $I = I_{cm}$
55. The perpendicular axis theorem can be expressed as? a) $I = I_{cm} + Md^2$ b) $I = Md^2$ c) $I = I_x + I_y$ d) $I = I_{cm}$
56. $T^2 \alpha r_s^3$ is an expression for __? a) Kepler's first law b) Kepler's second law c) Kepler's Third law d) fourth Kepler's law
57. In Kepler's second law the distance of closest approach between the earth and the sun is known as? a) aphelion b) eccentric c) perihelion d) orbit
58. _____, is the centre of mass along the Y –axis. (a) $X_{cm} = \sum_1^n \frac{m_i x_i}{M}$ (b) $Z_{cm} = \sum_1^n \frac{m_i z_i}{M}$ (c) $Y_{cm} = \sum_1^n \frac{m_i y_i}{M}$ (d) $R_{cm} = \sum_1^n \frac{m_i r_i}{M}$
59. Find the centre of mass for the system of four (4) particles m_1=m_2=2kg , m_3=1kg and m_4=3kg with (0,0), (0,1),(1,1), and (1,0) respectively. (a) 1.5m (b)1.0m (c) 0.5m (d) 0m
60. If $I = \frac{ML^2}{12}$ (for solid sphere). Find its radius of gyration? (a) $K = \sqrt{\frac{2l}{5}}$ (b) $K = l\sqrt{\frac{2}{5}}$ (c) $K = l\sqrt{\frac{1}{12}}$ (d) L= $\sqrt{\frac{l}{12}}$