PHY 114

1. Two cars took off from Ibadan at the same speed of 120kmh^{-1}, one travelling to Abuja and the other to Lagos. They naturally have the same velocity.
   a) True b) false c) most of the time
   d) only if their speed is constant through the journey
2. Which of the following statements is not true?
   a) Scalar quantities can be specified by magnitude only
   b) Vector quantities can be added geometrically and analytically
   c) The magnitude of the velocity of a body moving in a circular path is the same as that of its speed
   d) Scalars and vectors must be added in the same way.

Use the information below to answer questions 3 – 5.

Two forces $\vec{A}$ and $\vec{B}$ are 6N at 36° to the positive x-axis and 7N along the negative x-axis respectively

3. The magnitude of $\vec{A} + \vec{B}$ is
   a) 3.79N b) 2.79N c) 0.59N d) 12.37N
4. The direct of $\vec{A} + \vec{B}$ is
   a) N31.3°E b) N31.3°W c) N58.7E d) N58.7N
5. The magnitude of $\vec{A} - \vec{B}$ is
   b) 2.797N b) 12.37N c) 3.87N d) 0.59N
6. Which of these statements is/are correct?
   i) Kinematics is the study of motion without reference to the cause of the motion
   ii) Dynamics is the study of motion with reference to the cause of motion
   iii) Kinetimatics and dynamics are both branches of mechanics in physics
   iv) Only number (iii) above is correct.
   a) i) and ii) only b) iv only
   c) i) and (iv) only d) ii), iii) and iii) only

Use the information below t answer questions 7 – 10

A car starting from rest attains a speed of 120kmh-1 in 10 sec. It then continues with this speed for 10 minutes after which it is brought to rest in another 10 minutes.

7. The acceleration in the first segment of the journey is
   a) 33.3kms^{-1} b) 50.0kms^{-2} c) 5.0ms^{-2} d) 3.33ms^{-1}
8. The acceleration in the second segment is
   b) 2.3ms^{-1} b) 0.06ms^{-2} c) 0.00ms^{-2} d) 10.0ms^{-2}
9. The distance travelled in the last segment of the journey is
   a) 10km b) 9.9km c) 19.9km d) 20.0km

10. The total distance travelled in all the three segments of the journ... is
a) 36.1km b) 30.1km c) 33.1km d) 10.5km

11. Which of the following statement is/are not correct
i) Projectile motion is an example of motion in a plane
ii) Projectile motion can be described in terms of time, horizontal and vertical displacements
iii) Both vertical and horizontal velocities of projectile change in the course of motion
a) iii only b) ii and iii only c) I only d) ii only

12. The force $\vec{F}$ between two points masses m_1 and m_2 separated by a distance r is given as
$F = \frac{Gm_1m_2}{r^2}$, the dimension of G in this equation is
a) Nm^2kg b) $L^3M^{-1}T^{-2}$ c) $L^2M^{-2}T^{-1}$ d) $L^3M^{-1}T^{-1}$

13. Which of these statements is/are true
i) An object is an equilibrium when it moves with constant velocity
ii) The apparent weight is the force that an object excert on the platform of a scale
iii) Apparent weight is always greater than true weight
a) i) only b) ii and iii only c) iii only d) i and iii only

14. Which of these statements is/are false?
i) Work done by a force may be positive or negative
ii) Positive work done may indicate increase in kinetic energy
iii) It is not possible to have negative work done.
a) iii only b) I only c) ii only d) I, ii and iii

15. A body of mass 2kg initially at rest is acted on by a force $F = 55 + t^2N$. the velocity of the body at t = 5 second is
a) $148.3ms^{-1}$ b) $120ms^{-1}$ c) $158.3ms^{-1}$ d) $5ms^{-1}$

16. Which of the statement is/are not true of uniform circular motion?
i) The centripetal and centrifugal forces are always directed towards the entre
ii) Orbiting of satellites is an example of uniform circular motion
iii) The centre petal force is given as $\frac{mv^2}{r^2}$ where m, v and δ have their usual meaning
a) i only b) ii only c) i and ii d) iii only

17. A simple harmonic oscillator has a period of 0.001 seconds and an amplitude of 0.4m. the magnitude of its velocity at the centre of oscillation is
a) $40ms^{-1}$ b) $800\pi ms^{-1}$ c) $400ms^{-1}$ d) $1000ms^{-1}$

18. Which of the following is not true about Newton's third laws of motion?
    a) Every object has a form of inertia
    b) Forces always exists in pairs
    c) Acceleration of an object is directly proportional to the net force acting on the object
    d) None of the three laws is applicable in collision problems

19. A ball of mass 0.1kg moving with a velocity of $6ms^{-1}$ collides with another ball of mass of 0.2kg at rest. Calculate their common velocity if both move together after collision.
    a) $4\ ms^{-1}$ b) $2\ ms^{-1}$ c) $0.2ms^{-1}$ d) $0.18ms^{-1}$

20. At a distance 2R from the centre of the earth the weight of the body is 2.5N. What will be its weight at a distance 3R from the centre of the earth?
    a) 4.75N b) 3.75N c) 1.1N d) 0.8N

21. A particle of mass 0.2kg attached to the end of a string is whirled in a vertical order of radius 2.0m at a constant speed of $5ms^{-1}$. What is the tension in the string at the highest point on its path?
    a) 2.5N b) 0.5N c) 12.5N d) 4.5N

Use the following to answer questions 22 to 24

A car of mass $2.0 \times 10^3 kg$ is travelling to the north and at a sped of $15ms^{-1}$

22. The momentum of the car is
    a) $3.00 \times 10 kgms^{-1}$ b) $1.5 \times 10^4 kgms^{-1}$
    c) $3.0 \times 10^4 kgms^{-1}$ d) $3.0 \times 10^4 kgms^{-1}$ due north

23. If the velocity is tripled, by what factor does the momentum increased?
    a) 3 b) 2 c) 4 d) 9

24. If the velocity is tripled by what factor does not the kinetic energy increase?
    a) $^1/_3$ b) 3 c) 9 d) 6

25. Two arrows, mass 0.1kg each are shot horizontally with the same speed of 30ms-1, one from east and the other form south meeting at a point. Find the magnitude and direction f the total momentum of both arrows
    a) $4.2kgms^{-1}$ Northwest b) $4.2\ kgms^{-1}$ southwest
    c) $3.0kgms^{-1}$ 40° Northwest d) None of the above

Use the problem below to answer questions 26 and 27. Two cars A and B are moving in the same direction along a straight line. Car A has four times the momentum and twice the kinetic energy of B.

26. Determine the ratio of mass of A to that f B
    a) 4 b) 2 c) 8 d) 16
    b)

27. The ratio of velocity of A to B is
a) ½ b) 2 c) 4 d) 8

Use the problem below to answer questions 28 – 32
A disc of mass 20kg and radius of 0.15m is mounted on a horizontal cylindrical axle of radius 0.015m and of negligible mass N₀ frictional losses exist between the strings. Calculate
The momentum of inertial of the disk
a) 20.5 $kgms^{-1}$ b) $22.5 \times 10^{-2} kgms^{-2}$
c) $2.25 kgm^2s^{-1}$ d) $2.25 \times 10^{-3} kgms^{-1}$

28. The torque due to 20N force applied tangentially to the axle
a) 4.5Nm b) 33.0Nm c) 3.0Nm d) 0.3Nm

29. The angular velocity is the 20N force is applied for 12 seconds
a) $16.0 rads^{-1}$ b) $18.0 m^{s-1}$ c) $18.0 rads^{-1}$ d) $160.0 rads^{-1}$

30. The kinetic energy of the disc at the end of the 12 seconds
a) 22.8J b) 28.8J c) 2880J d) 280.8K

31. The time required to bring the disc to rest if a breaking force of 1N were applied tangentially to its rim
a) 240.0s b) 2400.0s c)24.0s d)12.0s

32. Which of these statements is not true when subtracting vector $\vec{B}$ from vector $\vec{A}$. We can simply reverse the direction of $\vec{B}$ and add it to $\vec{A}$.
a) We simply reverse the direction of $\vec{B}$ and add it to $\vec{A}$
b) We can use parallelogram law
c) We can use analytical method
d) We simply subtract both the magnitude and direction of $\vec{B}$ and that of $\vec{A}$

33. Which of these statements are correct
i) A rigid body is in equilibrium if its translational acceleration is zero
ii) If its angular acceleration is zero
iii) If the vector sum of all the forces acting on the body is constant
iv) If the net torque acting on the body is zero
a) i, ii and iv only b) i and ii only
c) i and iv only d) i, iii and iv only

34. A force bi + 4j – 10k acts tangentially to the circumference of a disc of radius 2i + j + 3k. Find the torque.
a) 2i – 2j + 14k Nm b) 22i – 38j – 2kNm
c) 46.13Nm d) 22i – 2j + 14kNm

35. Which of these has the same unit as Youngh Mofulus of elasticity
a) Strain b) stress

c) strain.stress d) $\frac{(\text{stress})^2}{\text{strain}}$

36. A metal rod 1m long and 0.5cm2 cross sectional area is found to stretch by 0.2cm. calculate the force on the rod of the Young's modulus of the metal is $2.0 \times 10^{11} Nm^{-2}$
a) $2.0 \times 10^{-19} N$ b) $5.0 \times 10^{-3} N$
c) $2.0 \times 10^{-3} N$ d) $5.0 \times 10^{-9} N$

37. A muscle requires a force of 50W for an elongation of 4cm. regarding the muscle as a uniform elastic cylinder, calculate the energy stored in it.
a) 1J b) 2J c) 4J d) 8J

38. The study of surface tension is applicable to
a) Liquid only b) solids only
c) liquids and solids only d) liquids, solids and gases

39. At the terminal velocity, a solid moving through a fluid has a
a) Uniform velocity and all the force must be balance
b) Uniform velocity but all the forces do not balance
c) Velocity changing uniformly and all the forces on it balance
d) Velocity changes uniformly but all the forces on it do not balance

PHY 114

1. The respective dimensions for frequency, energy and pressure are
   a) T, ML^2T^2, $ML^{-1}T^{-2}$ b) T^{-1}, ML^2T^2, $ML^{-1}T^{-2}$
   c) T^{-1}, ML^2T^{-2}, $ML^{-1}T^{-2}$ d) T, ML^2T^{-2}, $ML^{-2}T^{-2}$
2. Which of the set of quantities have the same basic units?
   a) Power, work, moment b) work, moment, momentum
   c) moment, work and energy d) work, energy and power
   e) none of the above
3. Given that $E = \sqrt{2/t}$ where q has the dimension of energy and it has the dimension of time. What is the dimension of E?
   a) $M^{-2}T^{-2}, L^2T^3$ b) $M^{-½}L^{½}T^{½}$
   c) $M^{-3/2}L^{½}T^{½}$ d) $M^{-½}LT\ M^{-3/2}$
4. If vector A has components Ac = 3.2m and Ay = 1.6m. find the components Gx and Cy of vector C which is perpendicular to A if C has a magnitude of 5.0m?
   a) Cx = 2.0m and Cy = 5m b) Cx = 10m and Cy = 2m
   c) Cy = $\sqrt{5m}$ and Cx = $\sqrt{5m}$ d) Cx = $\sqrt{15m}$ and Cy = $\sqrt{10m}$
   e) Cx = $\sqrt{5m}$ and Cy = $\sqrt{20m}$
5. Two vectors P and Q are given as P = 3i – 4J + 5k and Q = 2j + 2k respectively. Find P. Q
   a) 1 b) 5 c) 2 d) -4
6. A body moving along the ace has its motion described by the equation $X = 406 + 5t^2$. What is the average velocity of the body during the first 5 seconds of its motion?
   a) $325ms^{-1}$ b) $5ms^{-1}$ c) $25\ ms^{-1}$ d) $65\ ms^{-1}$
7. A stone is projected from a surface at an angle of 30o to the horizontal and with an initial velocity of 40.0m/s. calculate the vertical component of the stones velocity 2.0s after leaving the surface if $g = 9.8\ ms^{-2}$
   a) $0.1\ ms^{-1}$ b) 0.2m/s c) 0.3m/s d) 0.4m/s e) 0.5m/s
8. A body moves from $r_1 = 2i + 3j + k$ to $r_2 = 3i – 2j-k$ (in metres) under the action of a force F = 2i – 3j + k (in Newtons). Find the work done by the force
   a) 10J b) 15J c) 20J d) 23J e) 32J
9. An alternative definition f impulse is
   a) A change in velocity
   b) Change in acceleration
   c) Change in momentum
   d) Change in torque

c) Change in energy

10. An object is found to have a position vector r = (4350 + 50t)I + 7000j + 2k with r in metres and t in seconds. If the mass of the object is 50kg. What is the momentum?
    a) 50j kgm/s b) 2500i kgm/s c) 50i $kgms^{-1}$
    d) $4000kgms^{-1}$ e) 5000i kgm/s

11. Calculate the speed of an artificial satellite of mass in places in a circular orbit of 180km above the surface of the earth. [Mass of the earth Me = 5-98 x 10^{24} kg]. Radius of the earth re = 6.38 x 106m and gravitational constant G = 6.67 x $10^{11}Nm^2kg^{-2}$]
    a) 5.6 x 10^3m/s b) 7.0 x 10^{14}m/s
    c) 7.8 x 10^{14}m/s d) 7.9 x 10^3m/s

12. The velocity of a particle in a simple harmonic motion has a maximum magnitude when
    a) The particle displacement from the position of equilibrium is maximum
    b) The particle displacement from the position of the equilibrium is zero
    c) The particle potential energy is maximum
    d) The particle acceleration in maximum
    e) None of the above occurs

13. Which of the following system is not in oscillatory motion?
    a) Atom in a solid
    b) Electrons in the antennas of radio and television transmitters
    c) Guitars strings which are plucked
    d) Balance wheel of a wrist watch

14. How much pressure is needed to compress the volume of an iron block by 0.11% is the bulk modulus of iron is 90 x 10^9Nm^{-2}?
    a) 7.5 x 10^7Nm^{-2} b) 8.0 x 10^8Nm^{-2} c) 9.9 x 10^7Nm^{-2}
    d) 7.5 x 10^9Nm^{-2} e) 9.9 x $10^{-13}Nm^{-2}$

15. A 0.2kg billard ball was hit with a rod such that it moved with a velocity of $3ms^{-1}$. If the impact between the ball lasted for 10^{-2}s, the impulsive force is
    a) 0.6N b) 0.4N c) 0.006N d) 4.0N e) 60N

16. A girl drop a bag inside a moving train. Her friends saw this helper from a platform. The bag drops 1m from rest when the train is moving steadily along the platform at $2ms^{-1}$. How long does it take for the body t reach the floor of the train?
    a) 0.19s b) 0.45s c) 0.35s d) No answer

17. From question 16, calculate the resultant velocity just before it hits the ground
    a) $2.0ms^{-1}$ b) $4.4ms^{-1}$ c) 4.8 ms^{-1} d) 0.735 ms^{-1}

18. The human adult tibia contracts by about 1mm per 1000N app force. By how much is the tibia of 75kg man contracts?
a) 0.75mm b) 0.735mm c) 0.735mm d) 0.735cm

19. A satellite weighs 80N at the earth's surface. If R is the earth radius, at what distance from the earth centre would the weight of the satellite by 20N?
a) $R/2$ b) $R/4$ c) 2R d) 4R

20. Calculate the least kinetic energy that must be given to a mass 2000kg at the earth's surface for the mass to reach a point a distance 9000km from the center of the earth $G = 6.7 \times 15^{11}Nmkg$ $M = 6 \times 10^{24}kg$ $R = 6.4 \times 10^{6}m$

21. Calculate the mass f the earth giving that the radius of the earth is 6400km $g = 9.8ms^{-2}$ $G = 6.7 \times 10^{-11}Nm^2kg^{-2}$
a) $5.99a \times 10^{18}kg$ b) $5.991 \times 10^{27}kg$
c) $5.991 \times 10^{24}kg$ d) $5.99 \times 10^{27}g$

22. A skaler brings her hands and legs close to her body so as to
a) Increase her moment of inertia
b) Increase the torque f her body
c) Reduce angular momentum
d) Reduce angular velocity

23. A flywheel completes 90 revolution in 30 seconds. What is the kinetic energy of the flywheel. Moment of inertia is $0.32kgm^{-2}$
a) 18.852J b) 5.76J c) 56.85J d) 113.73J

24. At the Olympic high diving competition, a diver from the top board curves her body in order to
a) Dive into the water with her legs b) Spin more
c) Increase her speed d) Increase her energy

25. What is the period of revolution of a spy satellite in a low earth orbit a distance 7100km from the centre of the earth when the grantation field strength is $8.0Nkg^{-1}$
a) 5900hrs b) 900min c) 570secs d) 1hr 38 mins

26. Which of the following is not true about performing arcular motion?
a) The weight of the body equals centripetal force
b) Acceleration is always directed towards the centre
c) The speed and velocity are constantly changing
d) None of the above

27. A stationary mass explodes into two parts, 4 unit and 40 units respectively. If the larger mass has initial K.E of 100J what is the initial K.E of the smaller mass?
a) 10kJ b) 1000kJ c) 100kJ d) 1kJ

28. Which of these does not represent work done?
a) Area under a pressure volume graph
b) Area under mass-volume graph
c) Area under a force-displacement graph
d) Area under a power-time graph

29. A man of mass 70kg walks at a uniform speed of $2ms^{-1}$ across a bridge 40m long and which has a mass of 1000kg. find the reaction at the ends A and B of the bridge if the mass stands at A.
a) A = 5000N B= 5700N b) 5700N B = 5000N
c) A = 10700N B = 5700N d) A = 5700N B = 10700N

30. Two bodies of masks 2kg and 3kg are connected by an inextensible rope over pulley calculate the acceleration if the system assuming the pulley is fractionless
a) $1.96ms^{-1}$ b) $1.96ms^{-1}$ c) $0.51ms^{-1}$ d) $0.51ms^{-1}$

31. An automobile travels up a hill at constant speed of 40km/h and returns down the hill at a constant speed of 70km/h. calculate the average speed round the trip.

32. Find the average velocity from number 31 above.

33. The position of a particle moving along the k axis is given in centimeters by x = 9.75 +1.50t3 where t is in seconds. Calculate the instantaneous velocity when the particle is mid way between its positions at t = 2.00s and t = 3.00s

34. A simple harmonic oscillator has a period of 0.025 sec and an amphitude of 0.4m. the magnitude of its velocity at the centre of oscillation is
a) $25272.73ms^{-1}$ b) $2000ms^{-1}$ c) $1800ms^{-1}$ d) $1600ms^{-1}$

35. If $\vec{d_1} = 3i - 2j + 4k$ and $\vec{d_2} = -5i + 2_1 - k$. What is $(\vec{d_1} + \vec{d_2}).(_{D_1} \times 4_{\vec{d_z}})$
a) 15 b) 0 c) 6 d) -24i – 68j – 16k

36. Three vectors are given by $\vec{a} = 3.0i + 5.0j$ and b = -1.0i – 4.0j + 2.0k and $\vec{c} = 2.0i + 2.0j + 1.k$ find $\vec{a}\ (\vec{b} \times \vec{c})$
a) 6 b) -24i + 25j c) -8i + 5j + 6k d) 1

37. The position $\vec{r}$ a particle moving in an xy plane is given by $\vec{r} = (2.00t^{-3} - 5.00t)I + (6.00 - 7.00t^4)j$ with r in metres and time in seconds. In unit vector notation calculate $\vec{a}$ at t = 2.00s
a) 72i – 336j b) 36i – 84j c) 36t + 336j d) 721i + 336j

38. What is the angle between the positive direction of the x-axis and a line tangent to the particles path at r = 2.00s?
a) 77.90 b) 282.1° c) 75.40 d) 284.6°

39. A ball is shot from the ground into the air. At a height 9.1m, its velocity is $\vec{v} = (7.6i + 6.1j)m/s$ with I horizontal and j upward. To what maximum height do the ball rise?
a) 20.4m b) 19.4m c) 19.3m d) 8.5m

40. Young Modules of elasticity is applicable to only
a) Gasses b) liquids c) plasmas d) solids