

UNIVERSITY OF ABUJA
FACULTY OF SCIENCE
DEPARTMENT OF PHYSICS
2016/2017 FIRST SEMESTER EXAMINATION

PHY101: Mechanics and Properties of Matter

April, 2017

INSTRUCTION: Answer All Questions in Section A and any two in Section B. All symbols have their usual meaning.

TIME: 3 Hours

Credit Units: 3

SECTION A

- Which of the following is a combination of base units? (a) m, s, kg, Am^{-2} , J, mol and cd (b) m, s, K, A, V, cd and mol (c) m, s, kg, K, A, Tesla and J (d) m, s, kg, K, A, mol and cd
- Kepler's first law states? (a) The path followed by a satellite around the primary will be a circle. (b) The path followed by a satellite around the primary will be a sphere. (c) The path followed by a satellite around the primary will be an ellipse. (d) All of the above
- A particle moves so that its position as a function of time in SI units is $\vec{r} = 2t^3\hat{i} + 5t\hat{j} - t^{3/4}\hat{k}$. Determine its acceleration as function of time.
(a) $6t^2\hat{i} + 5\hat{j} - t^{-1/4}\hat{k}$ (ms^{-2})
(b) $2t^2\hat{i} + 5\hat{j} - t^{1/4}\hat{k}$ (ms^{-2})
(c) $12t\hat{i} + \frac{3}{16}t^{-5/4}\hat{k}$ (ms^{-2})
(d) $6t^2\hat{i} + 5\hat{j} - \frac{3}{4}t^{-5/4}\hat{k}$ (ms^{-2})
- Define the terms in Eclipse. (a) During equinox periods, the earth the sun & the satellite are in alignment with the result that earth's shadow eclipses that satellite & the sunlight success to reach the satellite solar cells. (b) During equinox periods, the earth the sun & the satellite are in alignment with the result that earth's shadow eclipses that satellite & the sunlight fails to reach the satellite solar cells. (c) a & b (d) None of the above.
- A 6kg body has a velocity of $4\hat{i}$ ms^{-1} at one instant. Eleven seconds later, its velocity is $(3\hat{i} + 7\hat{j})$ ms^{-1} . Assuming the body was subject to a constant total force. Calculate magnitude of the total force.
(a) 3.27 N (b) 0.55 N (c) 3.86 N (d) 14.58 N
- Consider these situations: (i) a ball moving at speed v is brought to rest; (ii) the same ball is projected from rest so that it moves at speed v ; (iii) the same ball moving at speed v is brought to rest and then projected backward to its original speed. In which case(s) does the ball undergo the largest change in momentum?
(a) (i) and (ii) (b) (ii) and (iii) (c) (iii) (d) (i) and (iii)
- A woman walking briskly in rain with speed v must slant her umbrella forward making an angle β with the vertical. A 100L student derives the following relation between β and v : $\tan \beta = v$ and checks that the relation has a correct limit: as $v \rightarrow 0$, $\beta \rightarrow 0$, as expected. (We are assuming there is no strong wind and that the rain falls vertically for a stationary woman). Do you think this relation can be correct? If not, guess the correct relation.
(a) $\tan \beta = \frac{v}{v_r}$

(b) $\tan \beta = v^2$

(c) $\sqrt{\tan \beta} = \frac{3v}{5}$

(d) $\sqrt{\tan \beta} = 3v^{2/3}$

8. A typical small rescue helicopter, has four blades, each is 25cm long and has a mass of 135kg. The blades can be approximated as thin rods that rotate about one end of an axis perpendicular to their length. The helicopter has a total loaded mass of 6000kg. Calculate the rotational kinetic energy in the blades when they rotate at 270rpm.

(a) 3203.56 J (b) 159.19 J

(c) 1067.09 J (d) 4505.01 J

9. A person attempts to knock down a large wooden bowling pin by throwing a ball at it. The person has two balls of equal size and mass, one made of rubber and the other of putty. The rubber ball bounces back, while the ball of putty sticks to the pin. Which ball is most likely to topple the bowling pin?

(a) The rubber ball (b) The ball of putty

(c) Makes no difference (d) Need more information

10. Calculate the final speed of a solid cylinder that rolls down a 450cm high incline. The cylinder starts from rest, has a mass of 1.05kg, and has a radius of 0.07m.

(a) 58.8ms^{-1} (b) 7.7ms^{-1} (c) 13.3ms^{-1}

(d) 176.4ms^{-1}

11. Which of the following cannot be used to describe Bernoulli's equation for a moving fluid? (a) Bernoulli's equation is a simple and easy to use relation between pressure, velocity and elevation in a moving fluid. (b) Bernoulli's equation can be thought of as a limited version of the first law of thermodynamics. (c) The total terms varied along a streamline. (d) Work done on a fluid particle by pressure and gravity

forces is equal to the change in its kinetic energy.

12. Water is flowing in a fire hose with a velocity of 2.5ms^{-1} and a pressure of 400000 Pa. At the nozzle the pressure decreases to atmospheric pressure (101300 Pa), there is no change in height. Calculate the velocity of the water exiting the nozzle. (Hint: The density of water is 1000kgm^{-3} and acceleration due to gravity is 9.8ms^{-2}).

(a) 24.57ms^{-1} (b) 12.07ms^{-1}

(c) 30.18ms^{-1} (d) 14.18ms^{-1}

13. The laws of static and dynamic friction can be stated through the following except.

(a) The magnitude of the limiting force bears a constant ratio to the normal reaction between two surfaces. (b) The force of friction is independent of the area of the surface in contact. (c) Frictional force opposes the relative motion between two surfaces in contact. It acts in a direction opposite to that of the motion. (d) Force of friction is independent upon the roughness of the surfaces and on the nature of the two surfaces in contact.

14. Through a refinery, fuel ethanol is flowing in a pipe at a velocity of 1.5ms^{-1} and a pressure of 101300 Pa. The refinery needs the ethanol to be at a pressure of 2 atm (202600 Pa) on a lower level. How far must the pipe drop in height in order to achieve this pressure? Assume the velocity does not change. (Hint: The density of ethanol is 789kgm^{-3} and acceleration due to gravity, g is 9.8ms^{-2}).

(a) 19.259 m (b) -13.101 m

(c) -19.259 m (d) 8.734 m

15. A certain star, of mass m and radius r , is rotating with a rotational velocity ω . After the star collapses, it has the same mass but with a much smaller radius. Which statement below is true? (a) The star's moment of inertia I has decreased, and its

18. A particle of mass m impacts a smooth wall at $4u \text{ ms}^{-1}$ at an angle of 30° to the vertical. The particle rebounds with a speed $4\sqrt{3}u \text{ ms}^{-1}$ at 90° to the original direction and in the same plane as the impact trajectory. What is the coefficient of restitution between the wall and the particle?
 (a) 3 (b) $\sqrt{3}$ (c) $\frac{1}{\sqrt{3}}$ (d) $3\sqrt{3}$

19. A golf ball is fired at a bowling ball initially at rest and bounces back elastically. Compared to the bowling ball, the golf ball after the collision has: (a) ~~more momentum~~ but less kinetic energy. (b) more momentum and more kinetic energy. (c) less momentum and less kinetic energy. (d) less momentum but more kinetic energy.

20. A toy car moving at constant speed completes one lap around a circular track, a distance of 500m in 40s. If the mass of the car is 150mg, what is the magnitude of the central force that keeps it in a circle?
 (a) $2.945 \times 10^{-4} \text{ N}$ (b) $2.356 \times 10^{-2} \text{ N}$
 (c) $1.473 \times 10^{-4} \text{ N}$ (d) $4.689 \times 10^{-5} \text{ N}$

21. An automobile driver moving at 30 ms^{-1} suddenly saw a policeman standing 70m straight ahead at the Uniabuja main campus. If his reaction time is 0.5s and the maximum deceleration is 8 ms^{-2} , can he avoid hitting the policeman without steering to one side?
 (a) He cannot avoid hitting the policeman because he would have covered 1.25m beyond the point the policeman stood at the point of stopping. (b) He won't hit the policeman because his total distance covered is 56.25m which is less than the distance between him and the policeman. (c) He won't hit the policeman because the distance he covered before he applied the brakes is 15m ahead of him. (d) All of the above.

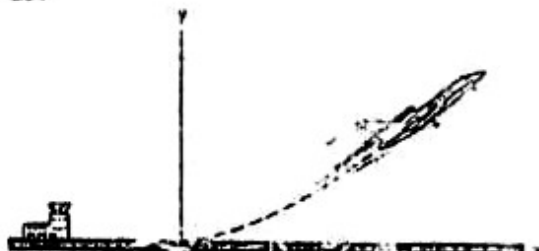
22. If an electron in copper near the lowest possible temperature has a kinetic energy of

$4.9 \times 10^{-21} \text{ J}$, what is the speed of the electron? (a) $1.08 \times 10^{-10} \text{ ms}^{-1}$
 (b) $9.80 \times 10^{-21} \text{ ms}^{-1}$ (c) $4.9 \times 10^{21} \text{ ms}^{-1}$
 (d) $1.04 \times 10^5 \text{ ms}^{-1}$

23. A 3kg bullet is stopped in a block of wood ($m = 0.8 \text{ kg}$). The speed of the bullet-plus-wood combination immediately after collision is 0.1 mms^{-1} . What was the original speed of the bullet? (a) $1.27 \times 10^{-4} \text{ ms}^{-1}$
 (b) $3.8 \times 10^{-4} \text{ ms}^{-1}$ (c) $8.0 \times 10^{-5} \text{ ms}^{-1}$
 (d) $3.8 \times 10^4 \text{ ms}^{-1}$

24. At what depth below the surface of oil, relative density 0.6, will produce a pressure of 100 kNm^{-2} ? (a) 0.017m (b) 17.01m
 (c) 17007m (d) 166667m

25.



The flight path of a jet aircraft as it takes off from the Nnamdi Azikiwe International Airport, Abuja is defined by the parametric equations $x = 1.25t^2$ and $y = 0.03t^3$, where t is the time after take-off, measured in seconds, and x and y are given in meters. At $t = 40\text{s}$ (just before it starts to level off), as shown above. Calculate at this instant its speed. (a) 175 ms^{-1} (b) 32.9 ms^{-1}
 (c) 100 ms^{-1} (d) 144 ms^{-1}

26. A train travels along a horizontal circular curve that has a radius of 200m. If the speed of the train is uniformly increased from 30 kmh^{-1} to 45 kmh^{-1} in 5s. Determine the magnitude of the acceleration at the instant the speed of the train is 40 kmh^{-1}
 (a) 1.451 ms^{-2} (b) 1.037 ms^{-2}
 (c) 0.617 ms^{-2} (d) 0.833 ms^{-2}

27. Through a refinery, fuel ethanol is flowing in a pipe at a velocity of 1.5 ms^{-1} and a pressure of 101300 Pa . The refinery needs the ethanol to be at a pressure of 2 atm (202600 Pa) on a lower level. How far must the pipe drop in height in order to achieve this pressure? Assume the velocity does not change. (Hint: The density of ethanol is 789 kgm^{-3} and acceleration due to gravity, g is 9.8 ms^{-2}). (a) -13.101 m (b) -19.259 m (c) 19.259 m (d) 8.734 m

28. A car accelerates from rest. In doing so the absolute value of the car's momentum changes by a certain amount and that of the Earth changes by: (a) A larger amount. (b) A smaller amount. (c) The same amount. (d) The smaller but depends on the interaction between the two.

29. An ideal fluid is

- (a) Incompressible, irrotational, viscous and non-steady flow. (b) Compressible, rotational, non-viscous and steady flow. (c) Incompressible, streamline or laminar, non-viscous and steady flow. (d) Compressible, irrotational, no turbulence and non-steady flow.

30. A body of mass 3 kg is attached to the hook of a spring balance and the latter is suspended vertically from the roof of a lift. Calculate the reading on the spring balance when the lift is descending with an acceleration of 0.2 ms^{-2} . (a) 28 N (b) 30.3 N (c) 29.4 N (d) 59.7 N

SECTION B

Q1 (a) State the Kepler's laws of planetary motion.

Q1 (b) Derive an expression for the moment of inertia of a solid cylinder about an axis passing through its center and perpendicular

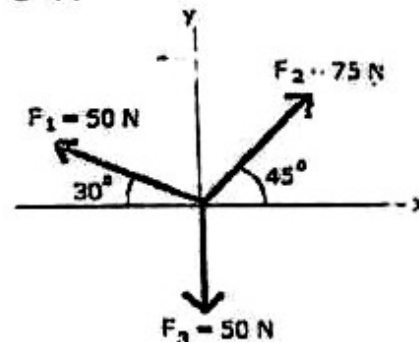
to its own axis of cylindrical symmetry.

Q1 (c) A body of mass 25 g moving with speed 4 ms^{-1} collides directly with another of mass 7 kg moving in the same direction. The coefficient of restitution is $3/4$. Determine the velocities after collision.

Q2 (a) What do you understand by the term surface friction?

Q2 (b) Derive an expression for the potential and field due to a thin circular disc at a point along its axis.

Q2 (c)



Calculate the magnitude of the resultant force, for the three forces shown above.

Q3 (a) State and explain the Continuity theorem.

Q3 (b) Derive an expression for the maximum height of a projectile motion on an inclined plane.

Q3 (c) A rectangular swimming pool is 2 m deep at one end and increases uniformly in depth to 4.1 m at the other end. The pool is 10 m wide and 45 m long and is emptied through an orifice of area 0.32 m^2 , at the lowest point in the side of the deep end. Suppose the discharge coefficient is 0.8 . Calculate the time to empty the pool completely.

BEST OF LUCK!!!

UNIVERSITY OF ABUJA
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DEPARTMENT OF MATHEMATICS
2016/2017 FIRST SEMESTER EXAMINATION

MTH 105
INSTRUCTION:

TIME:

COORDINATE GEOMETRY UNIT: 1
ANSWER ALL QUESTIONS IN SECTION A
AND ANY ONE (1) QUESTION IN SECTION B
1 HOUR, 30 MINUTES

A circle has the equation $x^2 + y^2 = 16$. What is the radius of this circle?
(a) 256 (b) 8 (c) 16 (d) 4

A circle has the equation $(x + 3)^2 + (y - 1)^2 = 4$. Which of the following statements is false?
(a) The x coordinate of the centre is -3 (b) The radius of the circle is 2
(c) The y coordinate of the centre is -1 (d) The point $(-3, -1)$ lies on the circle

O is the centre of a circle. P is a point on the circumference. The gradient of OP is 2.
What is the gradient of the tangent at P?
(a) 2 (b) 0.5 (c) -2 (d) -0.5

Determine the x -intercept and the y -intercept for the graph of the equation: $2x - 3y + 24 = 0$
a. x -intercept: -12; y -intercept: -8 b. x -intercept: 12; y -intercept: 8
c. x -intercept: -12; y -intercept: 8 d. x -intercept: 12; y -intercept: -8

A line has x -intercept 4 and y -intercept 7. Determine the slope of the line.
(a) $\frac{7}{4}$ (b) $\frac{-4}{7}$ (c) $\frac{-7}{4}$ (d) $\frac{4}{7}$

Write an equation for the line that passes through $T(-1, 4)$ and is parallel to the line $y = 6x - 6$.
(a) $y + 4 = \frac{-1}{6}(x - 1)$ (b) $y + 4 = 6(x - 1)$ (c) $y - 4 = \frac{-1}{6}(x + 1)$
(d) $y - 4 = 6(x + 1)$

The slope of line L is $\frac{-1}{3}$. What is an equation of a line that is perpendicular to line L?
(a) $y + 2 = \frac{1}{3x}$ (b) $-2x + 6 = 6y$ (c) $9x - 3y = 27$ (d) $3x + y = 0$

What is the equation of a circle whose center is 4 units above the origin in the coordinate plane and whose radius is 6?
(a) $x^2 + (y - 6)^2 = 16$ (b) $y^2 + (x - 6)^2 = 16$ (c) $x^2 + (y - 4)^2 = 36$
(d) $y^2 + (x - 4)^2 = 36$

What is the slope of a line that is perpendicular to the line whose equation is $3x + 5y = 4$?
(a) $\frac{-3}{5}$ (b) $\frac{3}{5}$ (c) $\frac{5}{-3}$ (d) $\frac{5}{3}$

A line segment has endpoints $A(7, -1)$ and $B(-3, 3)$. What are the coordinates of the midpoint of \overline{AB} ?
(a) (1, 2) (b) (2, 1) (c) (-5, 2) (d) (5, -2)

In circle O, a diameter has endpoints $(-5, 4)$ and $(3, -6)$. What is the length of the diameter?
(a) $\sqrt{2}$ (b) $2\sqrt{2}$ (c) $\sqrt{10}$ (d) $2\sqrt{41}$

12. A circle has the equation $(x - 2)^2 + (y + 3)^2 = 36$. What are the coordinates of its center and the length of its radius?
 (a) $(-2, 3)$, 6 (b) $(2, -3)$, 6 (c) $(-2, 3)$, 36 (d) $(2, -3)$, 36
13. Find the equation of the straight line which passes through $(-2, 3)$ and $(4, -5)$
 (a) $3y + 4x - 1 = 0$ (b) $4y + 3x - 1 = 0$
 (c) $3y - 2x - 1 = 0$ (d) $-5y + 4x - 1 = 0$
14. The equations of \overline{PQ} and \overline{PR} are $x - 3y + 11 = 0$ and $3x - y + 1 = 0$ respectively. Find the coordinates of P.
 (a) $(1, 4)$ (b) $(-1, 4)$ (c) $(4, -1)$ (d) $(-4, -1)$
15. Find the acute angle between $3x - y + 1 = 0$ and $x - 2y + 1 = 0$
 (a) 32.2° (b) 52.2° (c) 18.2° (d) 28.2°
16. Find the equation of the tangent to the circle $x^2 + y^2 = 13$ at the point $(2, -3)$
 (a) $2x - 3y = 13$ (b) $3x - 2y = 13$ (c) $x - 3y = 13$ (d) $2x - y = 13$
17. Find the point at which the line $3y - 12 = 4x$ cuts the y-axis.
 (a) $(0, 3)$ (b) $(0, 4)$ (c) $(0, 12)$ (d) $(0, 0)$
18. The two lines represented by the equations $x + y = \frac{2}{3}$ and $3(x - 2) = -3y - 4$ are graphed on a coordinate plane. Which statement best describes the two lines?
 (a) The lines are parallel.
 (b) The lines are the same line.
 (c) The lines are perpendicular.
 (d) The lines intersect at an angle other than 90° .
19. $(7, -2)$ and $B(-3, 3)$ are the end points of the line \overline{PQ} . Find the coordinate of the point A which divides the line the ratio 3:2.
 (a) $(1, -1)$ (b) $(1, 0)$ (c) $(0, 1)$ (d) $(1, 1)$
20. Determine the value of k if the equations $4kx - 2y - 10 = 0$ and $3x + 5y - 7 = 0$ represent parallel lines.
 (a) $\frac{-3}{7}$ (b) $\frac{-3}{10}$ (c) $\frac{-4}{7}$ (d) $\frac{-5}{7}$

SECTION B

- The straight line $3x - 4y - 3 = 0$ cuts the circle $x^2 + y^2 - 16x - 8y + 30 = 0$ at the points P and Q
- Find the coordinates of P and Q
 - Calculate the length of the chord PQ.

Let the lines L, M and N be represented by the equations $x + y - 5 = 0$, $2x + 3y - 13 = 0$ and $5x - 2y - 4 = 0$, respectively.

- Show that the lines L, M and N are concurrent.
- Find their common point

**UNIVERSITY OF ABUJA
FACULTY OF SCIENCE
DEPARTMENT OF PHYSICS
2016/2017 FIRST SEMESTER EXAMINATION**

PHY108: Basic Experimental Physics I

INSTRUCTION: Answer All Questions in Section A and any one in Section B. All symbols have their usual meaning.

TIME: 1 Hour

April, 2017

Credit Units: 1

SECTION A

1. Which of the following is not a practical steps in identifying sources of error? (a) Repeating measurement. (b) Inspection of the equipment and its environments to check for obvious faults. (c) Investigation of the credentials of any calibrations standards or other data used. (d) None of the above

2. The prevailing physical conditions that could affect laboratory practical include the following except: (a) Precision (b) Draught (c) Pressure (d) Temperature

3. The measure of two quantities along with the precision of their respective measuring instrument is given as: $A = (2.5 \pm 0.5)ms^{-1}$
 $B = (0.10 \pm 0.01)s$. The value of AB and \sqrt{AB} will be:

4. Explain the following types of error
(a) Random error (b) Systematic error
(c) Erratic error (d) Maximum error

SECTION B

Q1. In an experiment to determine the value of the acceleration due to gravity (g), using simple pendulum method, the following results are obtained for 40 oscillations

H (cm)	Time, t (s)	T (s)	T ² (s ²)
90.0	29.25		
80.0	27.01		
70.0	24.70		
60.0	21.20		
50.0	19.85		
40.0	15.50		
30.0	14.10		

(a) Copy and complete the table above by finding T and T^2 .

(b) Plot a graph of H against T^2 .

(c) Determine the slope S of the graph, standard error in the slope and intercept I on the vertical axis. State any two precautions taken to ensure accurate results.

Q2. The following values are obtained in an experiment to verify Hooke's law and acceleration of free fall due to gravity using spiral spring for 30 oscillations. $l_0 = 60cm$

L (cm)	Mass, m (g)	T (s)	T ² (s ²)
63.0	70.0		
64.3	90.0		
66.0	110.0		
67.3	130.0		
69.0	150.0		
70.5	170.0		

(a) Copy and complete the table above by finding T and T^2 .

(b) Plot a graph of e against T^2 .

(c) Determine the slope S of the graph, standard error in the slope and intercept I on the vertical axis. State any two precautions taken to ensure accurate results.

BEST OF LUCK!!!

UNIVERSITY OF ABUJA
FACULTY OF SCIENCE
DEPARTMENT OF MATHEMATICS
2018/2019 FIRST SEMESTER EXAMINATION
MTH 103: TRIGONOMETRY

UNITS: 1

Time: 1HR 30 MINS

INSTRUCTION: ANSWER ALL QUESTIONS IN SECTION A AND ONE QUESTION IN SECTION B

SECTION A

1. If $\sin 2\theta = \cos \theta$, find θ between 0° and 360°
 A. 45° , B. $135^\circ, 315^\circ$ C. $45^\circ, 315^\circ$ D. 30°
2. If A lies in the third quadrant and $3 \tan A - 4 = 0$, then $5 \sin 2A + 3 \sin A + 4 \cos A =$
 A. 0 B. $-24/5$ C. $24/5$ D. $48/5$
3. Which of the following is correct
 A. $\sin 1^\circ > \sin 1$ B. $\sin 1^\circ < \sin 1$ C. $\sin 1^\circ = \sin 1$ D. $\sin 1^\circ = \frac{\pi}{180^\circ} \sin 1$
4. If $\cos x = \tan y$, $\cos y = \tan z$ and $\cos z = \tan x$ then $\sin x$ equals
 A. $\sin y$ B. $\sin z$ C. $2 \sin 18^\circ$ D. $\sin(y + z)$
5. If in a triangle ABC, $\cos 3A + \cos 3B + \cos 3C = 1$, then one angle must be exactly equal to
 A. $\frac{\pi}{3}$ B. $\frac{2\pi}{3}$ C. π D. $\frac{4\pi}{3}$
6. Convert $3\frac{\pi}{4}$ radian to degree
 A. 145° B. 45° C. 135° D. 30°
7. The number of values of x for which $\sin 2x + \cos 4x = 2$ is
 A. 0 B. 1 C. 2 D. infinite
8. Express $\cot \frac{7\pi}{3}$ in terms of the trigonometric ratios of acute angles
 A. $\cot \frac{\pi}{4}$ B. $\cot \frac{\pi}{6}$ C. $\cot \frac{\pi}{3}$ D. $\cot \frac{\pi}{5}$
9. The value of $\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$ is equal to
 A. $\frac{\pi}{4}$ B. $\frac{5\pi}{12}$ C. $\frac{3\pi}{4}$ D. $\frac{13\pi}{12}$
10. A tower subtends an angle of 30° at a point on the same level as the foot of the tower. At a second point, h meter above the first, the depression of the foot of the tower is 60° , horizontal distance of the tower from the point is
 A. $h \cot 60^\circ$ B. $\frac{1}{3}h \cos 30^\circ$ C. $\frac{1}{3}h \cot 60^\circ$ D. $h \cot 30^\circ$
11. The value of $\tan 1^\circ \tan 2^\circ \tan 3^\circ \dots \tan 89^\circ$ is equal to
 A. -1 B. 2 C. $\frac{\pi}{2}$ D. 1

12 The minute hand of a clock moves from 1.30 to 5.30 on the face of the clock. Assuming that the length of the minute hand is 7cm, find correct to 3 significant figures the area swept by the minute hand (Take $\pi = \frac{22}{7}$) (a) 51.3cm^2 (b) 53.1cm^2 (c) 53.3cm^2 (d) 35.1cm^2

13 Which of the followings is not an identity? (a) $\sin^2 x + \cos^2 x = 1$ (b) $\sin x = \tan x \cos x$ (c) $1 + \cot^2 x = \csc^2 x$ (d) $1 - \sec^2 x = \tan^2 x$

14 Simplify $\sin t + \frac{\cos^2 t}{\sin t}$ (a) $\sin t$ (b) $\csc t$ (c) $\sec t$ (d) $\cos t$

15 If $0 < t < 2\pi$, such that $\sin t = \frac{\sqrt{2}}{2}$ and $\cot t < 0$. Then $t = ?$

(a) $\frac{\pi}{4}$ (b) $\frac{5\pi}{4}$ (c) $\frac{7\pi}{4}$ (d) $\frac{3\pi}{4}$

16 If $-2\pi < t < 0$ and $\sin t = \frac{-1}{2}$, what is the value of t ?

(a) $\frac{-5\pi}{6}$ (b) $\frac{-7\pi}{6}$ (c) $\frac{-5\pi}{4}$ (d) $\frac{-5\pi}{3}$

17 What is the measure in degrees of the angle $A = \frac{7\pi}{6}$?

(a) 150° (b) 210° (c) 100° (d) 120°

18 What is the measure in radian the angle $A = -750^\circ$?

(a) $\frac{-25\pi}{6}$ (b) $\frac{25\pi}{6}$ (c) $\frac{-15\pi}{6}$ (d) $\frac{-35\pi}{6}$

19 Which of the following points is a unit circle?

(a) $(\frac{-\sqrt{2}}{2}, \frac{-\sqrt{2}}{2})$ (b) $(\frac{\sqrt{2}}{3}, \frac{-\sqrt{2}}{3})$ (c) $(\frac{1}{2}, \frac{1}{2})$ (d) $(\frac{3}{2}, \frac{2}{3})$

20 If $\tan x = 5$, find $\tan 2x$

(a) 10 (b) $\frac{-5}{12}$ (c) $\frac{1}{10}$ (d) $\frac{5}{12}$

SECTION B

1) a. A ladder with its foot in the street makes an angle of 30° with the street when its top rest on a building on one side of the street and makes an angle of 40° with the street when its top rests on a building on the other side of the street. If the ladder is 50ft long, how wide is the street?

b. Find the area of an isosceles triangle with base of 19.2cm and base angle of $23^\circ 10'$.

2) a. Solve the equation $\cos 2x + \cos x + 1 = 0$

b. If $A + B + C = 180^\circ$, show that $\tan A + \tan B + \tan C = \tan A \tan B \tan C$

UNIVERSITY OF ABUJA
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DEPARTMENT OF MATHEMATICS
2016/2017 FIRST SEMESTER EXAMINATION
MTH 101: ELEMENTARY SET THEORY AND ALGEBRA UNITS: 2 TIME: 2 HOURS

TYPE C

INSTRUCTION: Answer all questions in section (A) and one question in section (B)
Use H.B. pencil to shade the OMR Sheet and to write the question type

SECTION A

1. Simplify $\sqrt{1000} - \sqrt{40} - \sqrt{90}$. (a) $10\sqrt{5}$ (b) $5\sqrt{10}$ (c) $2\sqrt{10}$ (d) $2\sqrt{5}$
 2. Given that x is real and $x \neq 0$, simplify the expression $(x - \frac{1}{x})^2 + (x + \frac{1}{x})^2$
(a) $2(x^2 + \frac{1}{x^2})$ (b) $2(x^2 + \frac{1}{x})$ (c) $2x^2 + \frac{1}{x^2}$ (d) $x^2 + \frac{1}{x^2}$
 3. Simplify $\frac{\log_{10} 125}{\log_{10} 25}$. (a) $2/3$ (b) 5 (c) $1/5$ (d) $3/2$
 4. Find the value of $\frac{6^{1/2} \cdot 9^{1/4}}{216^{1/4}}$ (a) $(\frac{2}{3})^{1/4}$ (b) $(\frac{3}{4})^{3/4}$ (c) $(\frac{3}{2})^{1/4}$ (d) $(\frac{1}{2})^{1/4}$
 5. Solve $\log_2 x + \log_x 4 = 3$ (a) 2 or 4 (b) 1 or $\frac{1}{2}$ (c) 1 or -2 (d) $\frac{1}{2}$ or -4
 6. Solve for x ; $9^{2x+1} - 10 \cdot 3^x + 1 = 0$ (a) 1 or 9 (b) 1 or $1/9$ (c) 1 or 0 (d) 0 or -2
 7. Express $\frac{3\sqrt{2}-\sqrt{3}}{2\sqrt{3}-\sqrt{2}}$ in the form $\frac{\sqrt{m}}{\sqrt{n}}$, where m and n are whole numbers
(a) $\frac{\sqrt{6}}{\sqrt{10}}$ (b) $\frac{\sqrt{150}}{\sqrt{100}}$ (c) $\frac{2\sqrt{6}}{\sqrt{10}}$ (d) $\frac{3\sqrt{6}}{\sqrt{10}}$
 8. Solve the equation $\sqrt{x+8} + \sqrt{x+1} = 7$ (a) 8 (b) 9 (c) 7 (d) 6
 9. The 8th term of a linear sequence is 18 and the 12th term is 26. Find the first term and the common difference (a) 4 and 2 (b) 2 and 4 (c) 3 and 4 (d) 1 and 4
 10. If $(y+1)$, $(2y-1)$ and $(3y+1)$ are three consecutive term of a G.P., find the common ratio.
(a) 0 and 4 (b) 4 and -8 (c) 8 (d) 0 and 8
 11. Evaluate $\sum_{k=1}^{100} (3k+2)$ (a) 31550 (b) 302 (c) 5 (d) 15350
 12. If f and g are mappings defined on the set of real numbers by $f(x) = 3x+1$,
 $g(x) = x^2$. Find $f \circ g(x)$. (a) $(3x+1)^2$ (b) $3x^2+1$ (c) $9x^2+6x+1$ (d) $x^2(3x+1)$
 13. Let $f: x \rightarrow x^2+3$ be a function on the set of real numbers onto set of real numbers. Find the inverse function $f^{-1}(x)$. (a) x^2-3 (b) x^2+3 (c) $\sqrt{x+3}$ (d) $\sqrt{x-3}$
 14. Find without the use of table the possible value of y if $5^{x^2-16} = 625(5^{8y})$
(a) 10 and 2 (b) 10 and -2 (c) 10 and 5 (d) -10 and -1
 15. If $\frac{1}{8}x = 1 \cdot 9^2 - 1 \cdot 1^2$ find the exact value of x . (a) 19.2 (b) 12.1 (c) 29.1 (d) 91.2
 16. Find the value of x if $\log_2 x^2 = -8$ (a) $1/16$ (b) 16 (c) -64 (d) 64
 17. Given that $\sqrt{5} = 2.236$, evaluate $\frac{3}{2\sqrt{5}}$ (a) 0.7608 (b) 0.6708 (c) 0.8076 (d) 0.7206
 18. Simplify $\frac{4!4!}{2!2!2!}$ (a) 2! (b) 4! (c) $3 \times 4!$ (d) $4 \times 4!$
 19. Find the number of ways of arranging the word MATHEMATICS
(a) 4889600 (b) 4898005 (c) 4889006 (d) 4889600
 20. A committee consisting of 3 men and 5 women is selected from 5 men and 10 women. Find how many ways the committee can be formed (a) 262 (b) 226 (c) 622 (d) 2520
 21. A school Principal and his wife as well as three other teachers are to be seated in a row so that the principal and his wife are next to each other. Find the number of ways this can be done.
(a) 120 (b) 12 (c) 24 (d) 102
- Use the information below to answer questions 22 to 24
All the 1000 students in Faculty of Science, University of Abuja were asked their subject combinations. 360 of them offered Mathematics, 420 offered Chemistry while 320 offered Biology. 140 students offered Mathematics and Chemistry, 160 offered Mathematics and Biology, 180 students offered Chemistry and Biology while 100 offered the three subject combinations. Find
22. The number of students that offered Mathematics but offered neither Chemistry nor Biology
(a) 180 (b) 100 (c) 160 (d) 140
 23. The number of students who did not offer any of the three subject combinations

- (a) 720 (b) 440 (c) 470 (d) 380

24. The number of students who offer at least two subjects. (a) 280 (b) 360 (c) 420 (d) 380

Use the information below for questions 25 to 27

Let $U = \{\text{all natural numbers less than or equal to } 20\}$.

$A = \{\text{factors of } 12\}$, $B = \{x \mid 2 \leq x \leq 10, x \text{ is even number}\}$.

$C = \{\text{factors of } 16\}$

List the members of:

25. $A \cap B \cap C$.

(a) \emptyset (b) $\{1, 2, 4, 8, 16\}$ (c) $\{2, 4, 6, 8, 10\}$ (d) $\{7, 9, 11, 13, 14, 15, 16, 17, 18, 19, 20\}$

26. $A \cup B \cap C$.

(a) $\{3, 5, 7, \dots, 20\}$ (b) $\{3, 5, 6, 7, 9, 11, 13, \dots, 20\}$ (c) $\{3, 5, 6, 7, 9, 11, 13, 14, 15, \dots, 20\}$ (d) U

27. $(A \cup B \cup C)'$

(a) $\{3, 5, 7, 9\}$ (b) $\{5, 7, 9, 11, 13, 14, 15, 17, 18, 19, 20\}$ (c) $\{7, 9, 11, \dots, 20\}$ (d) U

28. A binary operation $*$ is defined on the set R of real numbers by:

$a * b = a + b + ab$. Find the identity element e of R under the operation

(a) a (b) 1 (c) $1 - a$ (d) 0

29. The operation $*$ on the set R of real numbers is defined by

$a * b = \frac{2a-1}{2} + b \forall a, b \in R$. Find the inverse of element $x \in R$

(a) $1 - a$ (b) $a - 1$ (c) $2 - 2a$ (d) $1 - 2a$

30. Determine the domain D of the mapping $f: x \rightarrow 2x + 3$, if $C = \{-3, -1, 5\}$

is the range and f is defined on D .

(a) $\{1, 2, 3\}$ (b) $\{-5, -3, 1\}$ (c) $\{-3, -2, 1\}$ (d) $\{-3, 1, 7\}$

31. If $\frac{16}{9}, x, 1, y$ are in GP. Find the product of x and y (a) $\frac{1}{4}$ (b) $\frac{4}{3}$ (c) 1 (d) $-\frac{4}{3}$

32. Find the 8th term of an exponential sequence whose first term is 3 and whose common ratio is 2.

(a) 128 (b) 384 (c) 4374 (d) 4473

33. Find p in the function $y = px^2 + 2x^2 - 3x + 4$ if y has value zero when $x = 1$

(a) 0 (b) -3 (c) 2 (d) -2

34. Find the remainder when $x^3 - 2x^2 + 5x + 8$ is divided by $x - 3$

(a) 32 (b) 27 (c) 24 (d) 42

35. If α and β are the roots of equation $4x^2 - 4x - 3 = 0$. Find $\beta\alpha^3 + \alpha\beta^2$

(a) $\frac{1}{4}$ (b) $\frac{7}{8}$ (c) $\frac{4}{7}$ (d) $\frac{21}{16}$

36. Resolve into its partial fraction $\frac{7x-1}{(2x-1)(2x+3)}$

(a) $\frac{4}{3x-1} + \frac{11}{2x+3}$ (b) $\frac{4}{2x-1} - \frac{11}{2x+3}$ (c) $\frac{1}{11} \left(\frac{4}{2x-1} + \frac{23}{2x+3} \right)$ (d) $\frac{1}{11} \left(\frac{4}{3x-1} + \frac{11}{2x+3} \right)$

37. If $\frac{1}{(x+2)(x+4)} = \frac{A}{x+2} + \frac{B}{x+4}$. Find the sum of A and B . (a) 1 (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) 0

38. Solve for x and y : $\frac{x}{3} + \frac{y}{3} = \frac{-1}{6}$, $x - 2 = -2$. (a) $\frac{3}{8}, \frac{5}{8}$ (b) $-\frac{3}{4}, \frac{5}{8}$ (c) $\frac{3}{4}, \frac{5}{8}$ (d) $\frac{3}{4}, \frac{3}{8}$

39. Evaluate: $\frac{-2+4i}{1+i}$. (a) $\frac{2+6i}{3}$ (b) $1+3i$ (c) $\frac{2+6i}{2}$ (d) $1-3i$

40. Evaluate: $\log_5 125 + \log_3 81 - \log_2 64$. (a) 13 (b) 3 (c) -1 (d) 5

SECTION B

1(a) Consider the following relations on the set $A = \{1, 2, 3, 4\}$

$R_1 = \{(1, 1), (1, 2), (2, 3), (1, 3), (4, 4)\}$

$R_2 = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4)\}$

$R_3 = \{(1, 3), (2, 1)\}$

$R_4 = \emptyset$

$R_5 = A \times A$.

Determine which of the relation(s) are (i) Reflexive (ii) Symmetric (ii) Transitive.

(b) Prove by Mathematical Induction that

$$1 + a + a^2 + \dots + a^n = \frac{a^{n+1} - 1}{a - 1}, \quad a \neq 1$$

2(a) If $Z_1 = 2 - i$, $Z_2 = 4i + 2$ and $\frac{1}{Z_1} = +Z_1^{-1} + Z_2^{-1}$, evaluate Z_1 in the form $x + iy$.

(b) Express $-6 - 4i$ in polar form.

41. 5

UNIVERSITY OF ADUJA
FACULTY OF SCIENCE
DEPARTMENT OF CHEMISTRY

2016/2017 FIRST SEMESTER EXAMINATION
CHEM 121: FOUNDATION CHEMISTRY I

UNIT: 3

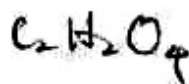
APRIL 2017

TIME ALLOWED: 2 HRS

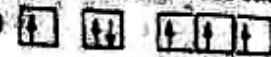

INSTRUCTIONS:

- Attempt all questions.
- Write the correct answers ONLY
- Constants: $1 \text{ nm} = 10^{-9} \text{ m}$, $h = 6.625 \times 10^{-34} \text{ Js}$ and $c = 3 \times 10^8 \text{ m/s}$
- $H = 1, C = 12, O = 16, Na = 23, N = 14, S = 32$

- The evidence that electrons were discrete particles was obtained by _____.
- In cathode tube experiment, when a high voltage is applied to any gas at low pressure, streams of particles moved from _____ to _____.
- Write a balanced equation for the reaction of oxalic acid and sodium hydroxide.
- 20 cm^3 of hydrochloric acid was titrated against 25 cm^3 of sodium hydroxide solution that contains 3.60 g in 1 dm^3 . Calculate: (i) concentration of A in mol/dm^3 (ii) concentration of A in g/dm^3 .
- _____ is the apparatus for transferring solid substances.
- The apparatus used for drying are _____ and _____.
- Rutherford in his atomic model experiment discovered _____.
- What is the mass of an electron _____.
- _____ theory postulated that elements are made up of indivisible particles called atoms.
- The quanta of energy emitted by hot bodies are given by _____.
- Degenerate orbitals are orbitals of _____ energies.
- Covalent bonds are formed as a result of _____.
- An element with atomic number 14 will have _____ principal quantum number.
- A sublevel with azimuthal quantum number, $l = 3$ will have _____ orbitals.
- Elements in periods 6 and 7 are called _____ and _____.
- The scattering of alpha particles is mainly caused by _____.
- The law of definite proportion states that: _____.
- Write the electron configuration of S^{2-} .
- The theory that atom consists of a central nucleus and orbiting electrons was based on _____.
- Mention one characteristic common to elements in the same period.
- In the periodic table, elements are arranged according to their _____.
- The tendency of an atom to loose electron when energized is _____.
- The energy emitted or absorbed by an element is said to be in specific amounts called _____.
- How many electrons are there in the Lewis structure of NO_2^- ?
- A spectrum in which different colours merge into each other is called _____.
- What is the wavelength, in nanometers, of a photon of light whose frequency is $5.53 \times 10^{14} \text{ Hz}$?
- What is a standard solution?
- Covalent compounds have predominantly lower melting and boiling points because _____.
- Give the number of lattice point in a body centered cubic unit cell.
- Electrical and thermal conductivity _____ across the period and _____ down the group.
- Bohr's theory of atom was inadequate in explaining _____.
- What phenomenon does ${}^{12}_6\text{A}$, ${}^{14}_6\text{A}$ depict _____.



- Which groups of elements are called the p block elements _____
14. How many unpaired electrons are there in Fe^{3+} ($Z = 26$) _____
 15. Give the sublevel name of quantum number, $n = 5, l = 2$
 16. Arrange the following in order of increasing ionic radius, K^+ , Cl^- and P^{3-} .
 17. Mention the bond types in NH_4^+ and C_2H_2 .
 18. In what group and period does element with atomic number 19 belong.
 19. Write the product of a compound formed by the combination of an element A having atomic number 12 with element B of atomic number 9.
 20. Calculate the molar mass of sodium sulphate.
 41. What is the charge on the atom with 12 protons, 11 neutrons and 10 electrons?
 42. The regular arrangement of ions in solid crystals is called _____
 43. Which is the highest occupied energy orbital in a silicon atom?
 44. Mention the number of electrons that can be accommodated by the quantum number, $n = 5$?
 45. Calculate the wavelength of radiation that emitted $331 \times 10^{-16} \text{ kJ}$.
 46. Which principal energy level will contain electrons with the lowest energy _____
 47. How many orbitals are contained in the second principal level ($n=2$) of a given atom?
 48. The s block elements of the periodic table are made up of _____ and _____.
 49. Which of the rules does each of the following electronic energy diagram violate.

(i)  (ii) 
 50. How many sublevels are there in the third principal quantum number?
 51. What type of bond exists in diatomic phosphorus?
 52. Arrange the following in order of decreasing atomic size; F, Ne and Mg.
 53. Mention any factor that affects ionization energy.
 54. _____ limits the maximum number of electrons in an orbital to two.
 55. The scientific proof that cathode rays are negatively charged particles was made by _____.
 56. The periodic table is divided into horizontal rows known as _____ and vertical columns known as _____.
 57. Arrange the following in order of decreasing electronegativity; N, Si and Al.
 58. _____ arises because of small instantaneous dipoles in atoms.
 59. Octet rule refers to the _____ during chemical combination.
 60. The chemical bond that holds together the atoms of solid metal or alloy is _____.
 61. The magnetic quantum number explains _____ of orbitals.
 62. Atomic numbers were discovered by _____ while the term orbital was first coined by _____.
 63. All _____ compounds are insoluble in organic solvents but soluble in polar solvents.
 64. The orbital names: s, p, d and f were derived from _____, _____, _____ and _____.
- Answer true or false for questions (65 - 70)
65. X-rays can be deflected by both magnetic and electric fields.
 66. Atoms of the same elements having different atomic number but same mass number are isotopes.
 67. In ionic bonding electrical forces between different charged ions hold the atoms together.
 68. Beryllium has higher ionization energy than oxygen.
 69. Line spectra cannot be used in the identification of elements.
 70. Atoms with larger size are more electronegative than atoms of smaller size.

GOOD LUCK

UNIVERSITY OF ABUJA
FACULTY OF SCIENCE
DEPARTMENT OF PHYSICS
SECOND SEMESTER 2017/2018 EXAMINATION

COURSE CODE: PHY103

COURSE TITLE: WAVES, OPTICS, SOUND AND MODERN PHYSICS

INSTRUCTION: ATTEMPT ALL QUESTIONS IN SECTION A AND THREE QUESTIONS IN SECTION B

TIME ALLOWED: 3 HRS

ALL SYMBOLS HAVE THEIR USUAL MEANINGS

SECTION A

- (a) At what point does resonance occur in a system?
- (b) Name any two applications of beat frequency.
- (c) The half-life of a radioactive element is 9 years. What fraction of the atom have decayed in 36 years?
- (d) Define Quality factor in a resonance.
- (e) When does a musical sound become a noise?
- (f) How different is α -particle from β -particle if a radioactive element is subjected to both emissions?
- (g) Use the graphical method to explain x-ray spectra.
- (h) The lowest note emitted by a stretched string has a frequency of 20 Hz. How many overtones are there between 20 Hz and 160 Hz?
- (i) Explain briefly the concept of Compton effect.
- (j) A small object 2 cm high stands vertically and 20 cm in front of a concave mirror of focal length 15 cm. Find the nature, position and size of the image.

SECTION B

- Q1 (a) What do you understand by half-life of a radioactive element?
(b) Plane progressive sound waves of frequency 200 Hz fall normally on a smooth wall. Determine the minimum distances from the wall at which the air molecules have maximum and minimum amplitude of vibration. Assume velocity of sound in air is 340 m/s.
(c) Determine the apparent frequency when an observer is moving towards a stationary sound source.
- Q2 (a) Differentiate between diffraction and refraction of a wave.
(b) A motor boat speeding at 15 m/s is moving in the same direction as a group of water waves of frequency 0.17/s and speed 9.3 m/s. What is the frequency with which wave exists pound on the motor boat?
(c) State the properties of the image formed by a plane mirror.
- Q3 (a) Briefly discuss the speed of sound in liquids.
(b) The image of an object in a convex mirror is 3 cm from the mirror. If the mirror has a radius of curvature of 20 cm, find the object position and the magnification.
(c) Enumerate the three respects in which notes may be similar or different.
- Q4 (a) What is the possible disadvantage(s) of echoes.
(b) While conducting a photoelectric effect experiment with light at certain frequency a reverse potential difference of 1.25 V is required to reduce the current to zero. Find the maximum kinetic energy and the maximum speed of the emitted photoelectrons.
(c) State the Characteristics of image formed by a concave mirror.