Philadelphia University
Faculty of Science
Department of Basic Sciences
Fall 2021/2022

Final Examination
General Physics 211101
Date: 24/01/2022 Monday
Time: Two hours

Name: **Student number:**

Check your section with [X] below:

General Physics (211101)

☒ Section	Lecture time	Day	Lecturer
☐ 1	(09:45 – 11:15)	Sun. & Tue	Mr. Mustafa Al-zyout
☐ 2	(12:45 – 14:15)	Sun. & Tue	Mr. Mustafa Al-zyout
☐ 3	(09:45 – 11:15)	Mon. & Wednes.	Mr. Mustafa Al-zyout
☐ 4	(11:15 – 12:45)	Sun. & Tue	Ms. Mariam Al-qderat
☐ 5	(14:15 – 15:45)	Sun. & Tue	Ms. Mariam Al-qderat
☐ 6	(08:15 – 09:45)	Mon. & Wednes.	Ms. Mariam Al-qderat

Useful information's: $g = 9.8\ m/s^2$

- Each of the following problems has 2 point.
- You have a total of 20 questions.
- The use of a non-programmable calculator is allowed only.

Good Luck

Instructors:
Mr. Mustafa Al-Zyout
Ms. Mariam Al-qderat

*Check your correct answer with **X** in the table below:*

Q. No.	A	B	C	D
1	X			
2				X
3		X		
4			X	
5		X		
6				X
7	X			
8			X	
9		X		
10			X	
11	X			
12		X		
13	X			
14			X	
15	X			
16				X
17	X			
18		X		
19			X	
20		X		

Q.01) A ball is thrown vertically downward from the top of a building with an initial speed of $(25\ m/s)$. It strikes the ground after $(2\ s)$. The height of the building (in m) is?
(A) 69.9 (B) 59.6 (C) 49.6 (D) 39.6

Q.02) An Olympic athlete throws a javelin at four different angles above the horizontal, each with the same speed: $30°$, $40°$, $60°$ and $80°$. Which two throws cause the javelin to land the same distance away?
(A) $30°$ and $80°$ (B) $40°$ and $60°$ (C) $40°$ and $80°$ (D) $30°$ and $60°$

Q.03) A $(70\ kg)$ person rides in an elevator while standing on a scale. The scale reads $(400\ N)$. The acceleration (in m/s^2) of the elevator is:
(A) -3.4 (B) -4.1 (C) -1.9 (D) -2.7

Q.04) A car travels around $(300\,m)$ radius flat curve at $(40\ m/s)$ at constant speed. What is the minimum static coefficient of friction which allows it to travel at this speed without sliding?
(A) 0.31 (B) 0.21 (C) 0.54 (D) 0.42

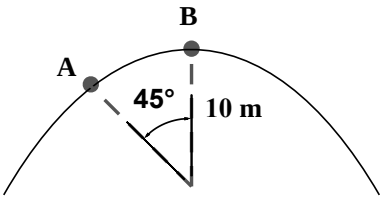
Q.05) A stone of a mass (m) is attached to a strong string and whirled in a vertical circle of radius $(r\ =\ 0.8\,m)$. At the top of the path the tension in the string is three times the stone's weight. What is the stone's speed (in m/s) at this point?
(A) 7.4 (B) 5.6 (C) 4.8 (D) 6.9

Q.06) A (2 kg) object change its position from $(x_i = 2\,m)$ to $(x_f = 6\,m)$ while a constant force $\vec{F} = 4\hat{\imath} + 2\hat{\jmath} - 4\hat{k}\ (N)$ acts on it. If the velocity of the object at the initial position is $(4\ m/s)$ and directed along x-direction. What is the final kinetic energy of the object at the final position (in J)?
(A) 40 (B) 36 (C) 28 (D) 32

Q.07) A conservative force $F_x = 12 - 6x(N)$, where x is in meters, acts on a particle moving along the $x - axis$. What is the change in potential energy (in J) of the particle as it moves from $(x = 0)$ to $(x = 1\,m)$?
(A) -9.0 (B) -10.0 (C) -9.5 (D) -10.5

Q.08) A force $\vec{F} = 4\hat{\imath} + 2\hat{\jmath} - 7\hat{k}\ (N)$ acts on a mass of $(2.3\,kg)$ as it moves in the x direction at a speed of $(7\ m/s)$. What is the time rate at which the force is doing work in $(Watts)$?
(A) 16 (B) 24 (C) 28 (D) 20

Q.09) A $(70\,kg)$ skier goes over a frictionless circular hill of radius $(10\,m)$ as shown. If the skier's speed at point (A) is $(9.2\ m/s)$. What is his speed (in m/s) at the top of the hill (point B)?
(A) 5.9 (B) 5.2
(C) 5.6 (D) 6.2



Q.10) A $(5\,kg)$ block on a rough horizontal surface is attached to a light spring $(\kappa = 1600\ N/m)$. The block passes through its equilibrium position with a kinetic energy of $(5\,J)$ and is brought momentarily to rest after stretching the spring $(0.06\,m)$. How much work is done by the frictional force on the block as it moves from its equilibrium position to the point of momentary rest (in J)?
(A) -5.1 (B) -4.1 (C) -2.1 (D) -3.1

Q.11) Rain is falling on an object at time t with a force of $\vec{F} = (8t\,\hat{\imath} - 3t^2\,\hat{\jmath})\,N$. Find the change in the object's momentum between $(t_i = 0)$ and $(t_f = 2\,s)$ (in $N.s$).
(A) $16\,\hat{\imath} - 8\,\hat{\jmath}$ (B) $8\,\hat{\imath} - 12\,\hat{\jmath}$ (C) $16\,\hat{\imath} - 12\,\hat{\jmath}$ (D) $8\,\hat{\imath} - 16\,\hat{\jmath}$

Q.12) A $(2\,kg)$ cart and a $(3\,kg)$ cart collide on a low-friction track. The $(3\,kg)$ cart is initially moving at $(1\ m/s)$ to the *right*, but after the collision it is moving at $(5\ m/s)$ to the *right*. After the collision, the $(2\,kg)$ cart is moving to the *right* at $(3\ m/s)$. What was the $(2\,kg)$ cart's initial velocity (in m/s)?
(A) $12\,m/s\,,left$ (B) $9\,m/s\,,right$ (C) $12\,m/s\,,right$ (D) $9\,m/s\,,left$

Q.13) A billiard ball moving at ($5\ m/s$) strikes a stationary ball of the same mass. After the collision, the first ball moves at ($4.33\ m/s$) at an angle of ($30°$) with respect to the original line of motion. Assuming an *elastic* collision, find direction of the struck ball's velocity after the collision.
(A) $60°$ (B) $30°$ (C) $53°$ (D) $37°$

Q.14) A bullet of mass ($10\ g$) strikes a *ballistic pendulum* of mass ($2\ kg$). The center of mass of the pendulum rises a vertical distance of ($12\ cm$). Assuming that the bullet remains embedded in the pendulum, calculate the bullet's initial speed (in m/s).
(A) 333 (B) 321 (C) 308 (D) 345

Q.15) A ($2\ kg$) particle has the xy coordinates ($-1.2\ m, 0.5\ m$), and a ($4\ kg$) particle has the xy coordinates ($0.6\ m, -0.75\ m$). Both lie on a horizontal plane. At what x and y coordinates must you place a ($3\ kg$) particle such that the center of mass of the three-particle system has the coordinates ($-0.5\ m, -0.7\ m$)?
(A) $-1.5m, -1.43m$ (B) $1.5m, 1.43m$
(C) $1.5m, -1.43m$ (D) $-1.5m, 1.43m$

Q.16) The angular position of a point on a rotating wheel is given by $\theta = 2 - 4t^2 - 2t^3$, where θ is in radians and t is in seconds. What is its angular acceleration at $t = 2\ s$ (in rad/s^2)?
(A) -15 (B) -40 (C) -30 (D) -32

Q.17) A drum rotates around its central axis at an angular velocity of ($12\ rad/s$). If the drum then slows at a constant rate of ($4\ rad/s^2$), through how many revolutions does it rotate in coming to rest?
(A) 2.9 rev. (B) 3.9 rev. (C) 3.4 rev. (D) 4.5 rev.

Q.18) What is the magnitude of the angular velocity of a spaceship taking a circular turn of radius ($3220\ km$) at a speed of ($29000\ km/h$) (in rad/s)?
(A) 0 (B) 2.5×10^{-3} (C) 9 (D) 0.15

Q.19) Calculate the moment of inertia of a meter stick, with mass ($0.5\ kg$), about an axis perpendicular to the stick and located at the ($20\ cm$) mark (in $kg.m^2$). (Treat the stick as a thin rod: $I_{c.m} = ML^2/12$).
(A) 0.121 (B) 0.104 (C) 0.087 (D) 0.139

Q.20) A particle located at the position vector $\vec{r} = 4\hat{\imath} + \hat{\jmath}\ (m)$ has a force $\vec{F} = 2\hat{\imath} + 3\hat{\jmath}\ (N)$ acting on it. Determine the vector product ($\vec{r} \times \vec{F}$) (in $N.m$) about the origin.
(A) $8\hat{\imath} + 3\hat{\jmath}$ (B) $10\ \hat{k}$ (C) 11 (D) $12\hat{\imath} - 2\hat{\jmath}$