16/20

جامعة بيرزيت
BIRZEIT UNIVERSITY
Faculty of Science كلية العلوم
Department of Physics

Physics 1431 Midterm Exam
Second Semester 2021/2022

Date: Tuesday 24/5/2022 **Time: 90 Minutes**

Student Name:	**Student ID:**

Please put (×) next to your discussion instructor name and circle your discussion section:

Instructor	Discussion Section #	
Abdallah Sayyed-Ahmad	1	
Fatimah Shamasneh	(2), 3 11:25 الاربعاء	×

Instructions:

- Write your name and student # where asked in the top of the sheet.
- Mark one box only using (×) in the answer sheet below to indicate the answer you consider best for each question.
- You cannot enter more than one (×) for a particular question. If you do, zero marks will be given for that question.
- Before you start the exam, make sure that you have 7 pages and 18 questions.
- Cell phones are not allowed and should be kept off during the exam.
- Last page has some useful constants and formulas.

Answer Sheet

	(a)	(b)	(c)	(d)	(e)
1					×
2		×			
3			×		
4					×
5	×				
6				×	
7		×			
8			×		
9	×				

	(a)	(b)	(c)	(d)	(e)
10			×	×	
11	×				×
12			×		
13				×	
14	×				
15					×
16			×		
17		×			
18	×				

$F = \frac{mv^2}{r}$

$\frac{4.0 \times 10^{-11} \times 0.15}{3.0 \times 10^{-16}} = v^2$ $\frac{m}{s}$

$\frac{120 \times 1000\ m}{3600\ sec} \times 0.5\ sec$

1) During a hard sneeze (عطسه قويه), your eyes might shut down for $0.51\ s$. If you are driving a car at $120\ km/h$ during such a sneeze, how far does the car move during that time?

(a) $4.0\ m$
(b) $7.0\ m$
(c) $14\ m$
(d) $21\ m$
(e) $17\ m$

$\frac{kg \cdot m}{s^2 \times kg \times m}$

$\frac{4.0 \times 10^{-11}}{3.0 \times 10^{-16}} = 1/s^2$

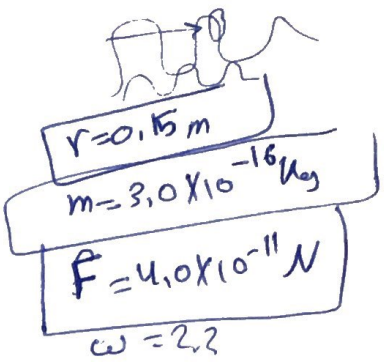
$\frac{rad}{sec}$

$F = \frac{mv^2}{r}$

$F = \frac{m\omega^2 r}{r}$

Lre = 2π rad $F = ma$ $kg \cdot m/s^2$

$* = 943$



2) Sound waves in air are best described as

(a) Transverse waves.
(b) Longitudinal waves
(c) Electromagnetic waves
(d) Polarized waves
(e) Torsional waves

$\omega r = v$

$\frac{4.0 \times 10^{-11}\ N}{3.0 \times 10^{-16} \times 0.15} = \omega^2$

943

942.8

$r = 0.15\ m$

3) A sample of blood is placed in a centrifuge (جهاز الطرد المركزي) of radius $15\ cm$. The mass of a red blood cell is $3.0 \times 10^{-16}\ kg$, and the magnitude of the force acting on it as it settles out of the plasma is $4.0 \times 10^{-11}\ N$. At how many revolutions per minutes (rpm) should the centrifuge be operated?

ω

F

(a) $3000\ rpm$
(b) $6000\ rpm$
(c) $9000\ rpm$
(d) $12000\ rpm$
(e) $1000\ rpm$

$\omega = \frac{v}{r}$

$\omega r = v$

$F = \frac{mv^2}{r}$

$\frac{m\omega^2 r}{r}$ $F = m\omega^2 r$

$4.0 \times 10^{-11}\ N = 3.0 \times 10^{-16}\ kg \times 0.15\ m \times \omega^2$

942

1 rev = 2π rad

$x = 942$

1 min = 60 sec

$\frac{22}{7} \times 1$

$\omega = \frac{v}{r}$

942.8 rad/sec

$F = \frac{mv^2}{r}$

$4.0 \times 10^{-11} = \frac{3.0 \times 10^{-16} \times v^2}{0.15}$

$6 \times 10^{-12} = 3.0 \times 10^{-16}\ v^2$

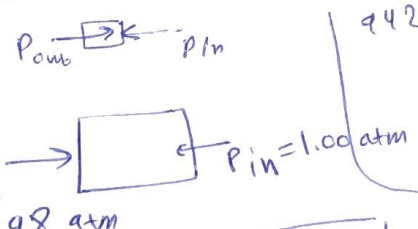
$141.42\ m/s = v$

942.8

$\frac{150.05\ rev}{\frac{1}{60}}$

4) The outside pressure drops to $0.98\ atm$ as a result of windy storm. If the inside pressure remains at $1.00\ atm$, the net force on a window of area $5.0\ m^2$ will be

(a) $2 \times 10^2\ N$
(b) $2 \times 10^3\ N$
(c) $5 \times 10^5\ N$
(d) $7 \times 10^3\ N$
(e) $1 \times 10^4\ N$



$P_{out} = \frac{F_{out}}{A}$

$P = \frac{F}{A}$ $P_{out} = 5 \times 10^5\ Pa$

$P_{in} = \frac{F_{in}}{A}$

$1\ atm = 1.01 \times 10^5\ Pa$

$0.98 \rightarrow ??$

$\Sigma P = \frac{\Sigma F}{A}$

$\Sigma P = \frac{\Sigma F}{A}$

$A = 5.0\ m^2$

$5.0 \times 98980 = F$

500000

5×10^5 2

$(3.0\times10^{-3})^2 = 2Dt$

$\frac{m^2}{s}$

$1m = 10^3 mm$

$1000\ kg/m^3$

$1\ g/cm^3$

$D_{gin\ H_2O} = 6.0\times10^{-10}\ m^2/s$

5) If the diffusion constant of glucose in water is $6.0 \times 10^{-10}\ \frac{m^2}{s}$, then the time it will take glucose molecules to diffuse an average distance of $3.0\ mm$ is

(a) $7.5 \times 10^3\ s$
(b) $2.5 \times 10^2\ s$
(c) $5.0 \times 10^4 s$
(d) $7.5 \times 10^5\ s$
(e) $2.5 \times 10^6\ s$

$\frac{(3.0\times10^{-3})^2}{2\times 6.0\times10^{-10}}$

$x_{rms} = \sqrt{2Dt}$

$x^2 = 2Dt$

$\frac{x^2}{2D} = t$

$F_b = \rho_{water} V g$

$mg = \rho_{H_2O} V g$

$m = 1000\times0.6$

$m = 600\ kg$

600 Kg

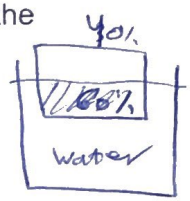
$F_b = mg$

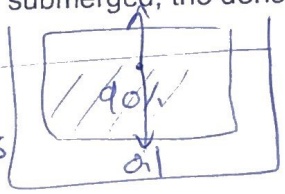
$\rho_{oil} V g = mg$

$\rho = \frac{m}{V} = \frac{600}{0.9}$

$666.6\ kg/m^3$ 0.6

6) A block of wood floats in water with 60% of its volume submerged (مغمور بالماء). If the same block floats in an oil with 90% of its volume submerged, the density of oil is





$\frac{\rho_f}{\rho_{obj}} = \frac{V_{obj}}{V_f}$

(a) $1.33\ g/cm^3$
(b) $0.30\ g/cm^3$
(c) $0.50\ g/cm^3$
(d) $0.67\ g/cm^3$
(e) $0.90\ g/cm^3$

$m = m$

$\rho_{oil} V = \rho_{water} V$

$\rho \times 0.9 = 1000\times0.6$

0.9

$666.7\ kg/m^3$

$\frac{666.7\times10^3\ g}{1000\ cm^3}$

$F_b = \rho_{oil} V g$

$F_b = \rho_{water} V g$

$F_b = 1000\times10\times0.6$

$F_b = 6000$

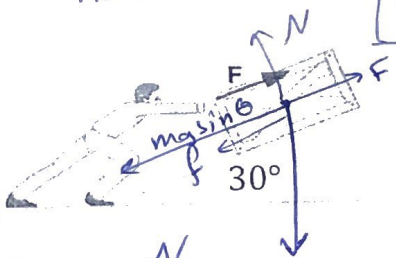
$(1m = 100\ cm)$

$1m^3 = 10^6 cm^3$

$1m^3 = 1000 cm^3$

7) A $50\ kg$ box is being pushed up a ramp (منحدر). If the coefficient of friction between the box and the ramp is $\mu = 0.11$, then the minimum force needed to move the box is

(a) 200 N
(b) 300 N
(c) 400 N
(d) 500 N
(e) 600 N



$F = mg\sin30 + f$

$= (50\times10\times0.5) + (0.11\times mg\cos30)$

$250 + (0.11\times 50\times10\times \frac{\sqrt{3}}{2})$

$297.6\ N$

$F = mg\sin\theta + f$

$= (500\times0.5) + (0.11\times500$

f

8) A violin is playing a note at $1200\ Hz$ when a second violin starts playing. There is a distinct pulse in the resultant mix which repeats 20 times over the course of 5 seconds. The possible frequencies of the second violin are

(a) 1180 Hz and 1220 Hz
(b) 1195 Hz and 1205 Hz
(c) 1196 Hz and 1204 Hz
(d) 1100 Hz and 1300 Hz
(e) 1000 Hz and 1400 Hz

$\frac{20}{5} = f_{new}$

4 Hz new f

$f_{new} = |f_2 - f_1|$

$4 = f_2 - 1200$

$-4 = f_2 - 1200$

1204

1196

1196

loudness → Intensity
pitch → frequency

9) The shortest time interval in which a wave motion completely repeats itself is called

(a) Period.
(b) Amplitude.
(c) Frequency.
(d) Speed.
(e) Wavelength.

A↑

B 

10) Consider two sound waves A and B. If wave A has a larger amplitude and wavelength than wave B, then

Amplitude

(a) Wave A is louder and higher in pitch than wave B.
(b) Wave A is quieter and higher in pitch than wave B.
(c) Wave A is quieter and lower in pitch than wave B.
(d) Wave A is louder and lower in pitch than wave B.
(e) Wave A is louder than wave B, but the pitch is the same.

A louder
B more pitch

$I = \frac{P}{A}$

A↑

$\lambda_A > \lambda_B$

$A_A > A_B$

$f_A < f_B$

↳ frequency

pitch A < pitch B

11) The horizontal tube shown has three section with different radii. Which of the following statements is true regarding the manometer pressure readings for these three sections

(a) $P_1 = P_2 = P_3$
(b) $P_1 < P_2 < P_3$
(c) $P_3 < P_2 < P_1$
(d) $P_3 < P_1 < P_2$
(e) $P_2 < P_1 < P_3$

$P_1 = P_2 = P_3$

هذا الجواب الصحيح

$2\pi r = 3 \times 10^3 m$

12) A car is travelling around a circular track at $120\ km/h$. If the track is $3.0\ km$ long, then the centripetal acceleration acting on the car as travels around the track is

v

(a) $1.1\ m/s^2$
(b) $5.7\ m/s^2$
(c) $2.3\ m/s^2$
(d) $0.8\ m/s^2$
(e) $4.6\ m/s^2$

$3000\ m = 2\pi r$

$477.5\ m = r$

$a = \frac{v^2}{r}$

$\frac{120 \times 10^3 m}{3600 sec}$

$2.327\ m/s^2$

high → low

13) Diffusion is the net migration of solute molecules

(a) from liquid water to the atmosphere.
(b) from the atmosphere to liquid water.
(c) from a region of low solute concentration to a region of high solute concentration.
(d) from a region of high solute concentration to a region of low solute concentration.
(e) None of the above.

14) During a particular car crash it takes just $0.25\ s$ (Δt) for the car to come to a complete stop ($v_f = 0$) from a velocity of $50\ km/h$. The magnitude of the car acceleration during the crash is

$v_i = 13.9\ m/s$

$v_f = v_i + at$

$0 = 13.9 + 0.25a$

$-13.9 = 0.25a$

$0 = 14 + 0.25a$

(a) $56\ m/s^2$
(b) $28\ m/s^2$
(c) $3.0\ m/s^2$
(d) $12\ m/s^2$
(e) $83\ m/s^2$

56

15) A person is found that just floats in water. If she weighs $600\ N$, her volume is

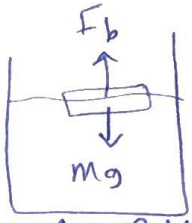
$F = mg = 600\ N$

$F_b = mg$

$F_b = \rho_f V_{obj} g$

$600 = 10000V$

$0.06\ m^3 = V$



$600 = \rho_f V_{obj}$

$\frac{60}{1000}$

(a) 20 *litres*
(b) 30 *liters*
(c) 40 *liters*
(d) 50 *liters*
(e) 60 *liters*

$1m^3 = 1000\ L$

0.06

$r_f = \frac{1}{2} r_i$

$A_i = \pi r_i^2$

$A_f = \pi r_f^2$

$A_f = \pi \times \frac{1}{4} r_i^2$

$A_f = \frac{A_i}{4}$

16) Water flows at a constant speed ($a = 0$) of $16\ m/s$ through a specific section of a horizontal pipe. What is the speed of water in another section of the same pipe that has half the radius of the first section?

$r_f = \frac{1}{2} r_i$

$A_i v_i = A_f v_f$

$r_i^2 \pi \times 16 = \pi \frac{r_i^2}{4} v_f$

$P_{initial} = P_{final}$

$\rho g h = \rho g h$

$A_1 v_1 = A_2 v_2$

$A_i v_i = A_f v_f$

$P = \frac{F}{A}$

$A_i = 4\pi r_i^2$

$A_f = 4\pi r_f^2$

$= 4\pi \frac{r_i^2}{4}$

$A_f = \pi r_i^2$

(a) $4\ m/s$
(b) $8\ m/s$
(c) $64\ m/s$
(d) $32\ m/s$
(e) $16\ m/s$

$A_i v_i = A_f v_f$

$4\pi r_i^2 \times 16 = \pi r_i^2 v_f$

$64\ m/s = v_f$

$A_i v_i = A_f v_f$

$A_i \times 16 = \frac{A_i}{4} v_f$

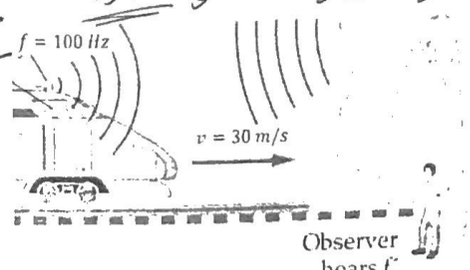
~~to~~ ① Electromagnatic force
② Gravitial force
③ Strong nuclear force
④ weak nuclear force

17) Which of one of the following forces is a fundamental force

(a) Friction
(b) Gravitational
(c) Tension
(d) Centripetal
(e) Drag

عندما يقترب يزداد علو الصوت لان الطائر يقل (-)

18) A train whistle (صفارة قطار) has a frequency of 100 hertz as heard by the engineer on the train. If the train is approaching a stationary listener on a windless day at a velocity of $30\ m/s$, the whistle frequency that the listener hears is approximately



(a) 110 Hz
(b) 120 Hz
(c) 80 Hz
(d) 92 Hz
(e) 150 Hz

$$f' = f\,\frac{(c \pm v_D)}{(c \mp v_s)}$$

$V_s \Rightarrow$ $f_s = 100$ Hz
$V_s = 30$ m/s
$V_D = 0$ m/s
$C = 330$ m/s

$$f' = 100 \times \frac{(330 + 0)}{(330 - 30)}$$

$f' = 110$ Hz

$$f' = f\,\frac{c}{c - v_s}$$