Physics 06 LACC Fa25 80/80 TEST1 Ch1-3 Name KEY

SHOW ALL WORK FOR FULL CREDIT. Each problem, or parts therein, is 5 pts, unless otherwise noted. Use the backsides or attach extra white paper to the back of the test if needed - just make a note.

5 **1.** The wavelength of a certain laser is 763 nanometers, where 1 nanometer = 1 × 10^{-9} m. Express this wavelength in millimeters.

$1\ mm = 10^{-3} m \rightarrow \boxed{1000\ mm = 1\ m}$

$$\boxed{763 nm \left(\frac{10^{-9} m}{1 nm}\right)\left(\frac{1000 mm}{1 m}\right)} = \boxed{763 \times 10^{-6} mm}$$

$7.63 \times 10^{-4} mm$

5 **2.** What is the sum of 3.21 + 5.713 + 1.7 using with the correct number of sig figs?

3.21
8.923
1.7
10.623

$\boxed{10.6}$

one decimal place

5 **3.** What is 24 + (11.00)/(3.2415 + 7.31) using with the right number of sig figs?

$$24 + \frac{11.00}{10.5515} = 24 + 1.0425 = \boxed{25}$$

5 **4.** An area of garden contains 6.7 acres. How many square meters does it contain? [1 acre = 43,560 ft^2], [1m = 3.281 ft]

$$(6.7 ac)\left(\frac{43,560 ft^2}{1 ac}\right)\left(\frac{1 m}{3.281 ft}\right)^2 = 27,111.2919 m^2$$

$$= \boxed{27,111.3 m^2} \sim 27,000 m^2$$

5 **5.** A toy car at t_1 = 1.1 s is at x_1 = 6.3 cm and at t_2 = 6.7 s is at x_2 = 17.1 cm. What is the average velocity over this time period? Are we able to calculate its average speed given this data? Explain?

① $(x, t) = (6.3 cm, 1.1 s)$

② $(x, t) = (17.1 cm, 6.7 s)$

$$V_{ave} = \frac{\Delta x}{\Delta t} = \frac{(17.1 - 6.3)}{(6.7 - 1.1)} = \frac{10.8 cm/s}{5.6}$$

$\boxed{V_{ave} = 1.93 cm/s}$

We do not know if the car was speeding up or slowing down in between measurements

① ②

very fast ave speed

5 **6.** A locomotive decreases its speed from 25 m/s to a stop in a distance of 199 m. Find the average acceleration.

25 m/s

0 m/s

199 m

$$V_f^2 = V_0^2 + 2 a \Delta x$$

$$\text{so } a = \frac{V_f^2 - V_0^2}{2 \Delta x}$$

assumed constant so this would be the "average" acc'ln

$$a = \frac{(0 m/s)^2 - (25 m/s)^2}{2 (199 m)}$$

$$= \boxed{-1.57 m/s^2}$$

decelerates 1.57 m/s every second

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7. (10pts) You are traveling to the beach during spring break at 60 km/h for a 199 km. It then starts raining so you decelerate to 45 km/h. You arrive at the motel after driving 4.2h. How far is the beach from your college? {Hint: Find the time for the first part of the trip first.}

60 km/hr 45 km/hr

College 199 km rain x km Beach

Distance	199	+	x	=	D
Time	t_1	+	t_2	=	4.2hr

10

$t_1 = \frac{d_1}{v_1} = 3.$

$t_1 = \frac{199\,km}{60\,km/hr}$

(i) $\boxed{t_1 = 3.317\,hr}$

(ii) $t_2 = 4.2\,hr - 3.32\,hr = \underline{0.88\,hr}$

(iii) $d_2 = v_2 t_2$

$d_2 = (45\,\frac{km}{hr})(0.88\,hr)$

$\boxed{d_2 = 39.6\,km}$ ⇒ 199 km + 39.6 km $\boxed{238.6\,km}$

8. A stopping car leaves skid marks 60 m long on the street. Assuming a constant deceleration of 2.77 m/s² , find how fast the car was moving just before braking.

$V_o = ?$ $V_f = 0\,m/s$

60m

$a = -2.77\,m/s^2$

5

$V_f^2 = V_o^2 + 2a\Delta x$

$V_o = \sqrt{V_f^2 - 2a\Delta x}$

$= \sqrt{0^2 - 2(-2.77\,m/s^2)(60\,m)}$

$= \sqrt{332.400}$

$= \boxed{18.23\,m/s}$

9. (a) Find how long it took a giant rock to fall straight down from the top of a cliff (110 m high), and (b) its speed just before landing.

(+)

110m

10

(b) $v_f^2 = v_o^2 + 2a\Delta y$

$V_f^2 = (0\,m/s)^2 + 2(+9.8\,m/s^2)(110\,m)$

$V_f^2 = 2156$

$\boxed{V_f = 46.43\,m/s}$

(a) $V_f = V_o + at$

$\frac{V_f - V_o}{a} = t$

$t = \frac{46.43 - 0}{9.8}$

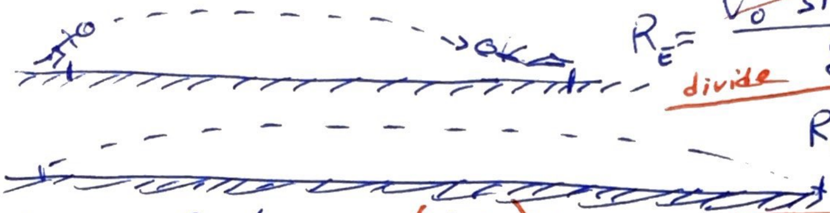
$\boxed{t = 4.74\,s}$

25

10. Estimate by what factor further an athlete can long jump on the Moon vs compared to the Earth if the takeoff speed and angles are the same? The acceleration due to gravity on the Moon is one-sixth what it is on Earth. {Form the ratio or the two Range Eqns}

5

Earth :



$R_E = \dfrac{\cancel{v_0^2 \sin 2\theta}}{g_E}$ cancels

divide

Moon :

$R_M = \dfrac{\cancel{v_0^2 \sin 2\theta}}{g_M}$ cancels

$\Rightarrow R_E / R_M = g_M / g_E = (\tfrac{1}{6} g_E)/g_E \Rightarrow \boxed{R_M = 6 R_E}$

11. (10 pts) Find the final force of these vectors: (1) 40 N, 26° north of east: (2) 10 N, 25° east of north; and (3) 30 N, 31° west of south. Populate the table:

Vector	x-component	y-component
1. 40N, 26° N of E	$40\cos 26° = 35.95$	$40 \sin 26° = 17.53$
2. 10N, 25° E of N	$10 \sin 25° = 4.23$	$10 \cos 25° = 9.06$
3. 30N, 31° W of S	$-30 \sin 31° = -15.45$	$-30 \cos 31° = -25.72$
	24.73N	0.87 N

TOTALS:

Final Discplacement:
* Magnitude:

$$\sqrt{24.73^2 + 0.87^2} = \sqrt{612.33} = 24.75\text{N}$$

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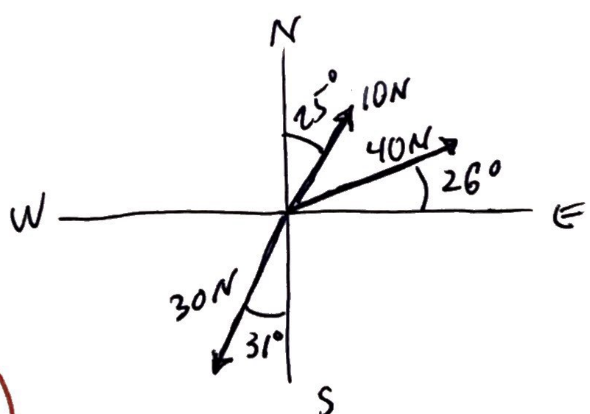
* Direction (use "10° N of W" style):

Both x- and y- are (+)
So Quadrant I

$$\theta = \tan^{-1}\left(\frac{0.87\text{N}}{24.73\text{N}}\right) = \boxed{2.0° \text{ N of E}}$$



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12. (10 pts) A bullet is fired with an initial speed of 35.2 m/s at an angle of 21.4° above the horizontal. Find (a) the maximum height reached by the bullet, (b) the total time in the air, and (c) the total horizontal distance covered (that is, the range).

y: $v_f^2 = v_0^2 + 2g\Delta y$

$0 = (V_0 \sin\theta)^2 - 2gH$

(a) Height

$$H = \frac{(V_0 \sin\theta)^2}{2g}$$

$$H = \frac{(35.2 \sin 21.4°)^2}{2(9.8)} = \underline{\underline{8.42\,m}}$$ (low!!)

(b) Time of Flight = 2 * Time to max H :

$V_f = V_0 - g t$

$0 = V_0 \sin\theta - g t$

$t = \frac{V_0 \sin\theta}{g}$

$$\Rightarrow t = \frac{(35.2\,m/s)\sin(21.4°)}{9.8\,m/s^2}$$

10

$t = 1.31\,sec$ $\ast 2$

$\boxed{T_{of}F = 2.62\,s}$

(c) Range:

$$R = \frac{V_0^2 (\sin 2\theta)}{g}$$

$$R = \frac{(35.2\,m/s)^2 \sin(2(21.4))}{9.8\,m/s^2}$$

$\boxed{R = 85.9\,m}$

-OR-

$$D = vt \Rightarrow \underbrace{[35.2 \cos(21.4°)]}_{V_x} \cdot (2.62\,s) = \underline{\underline{85.86\,m}}$$

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