	Total	K+E	I+O
Student	39	21	18
Average	51.4 /100	48.6/100	54.6/100
Best	80.5 /100	72.5/100	80.5/100

11thG Physics (2018– 19)

1st Q Exam- Honors

(November 1, 2017)

Class	No.	Name Solutions

In calculation problems, describe equations clearly and systematically enough to show how to solve the problems. If not enough, you won't get any points.

(4) m/s

0.50 (m)

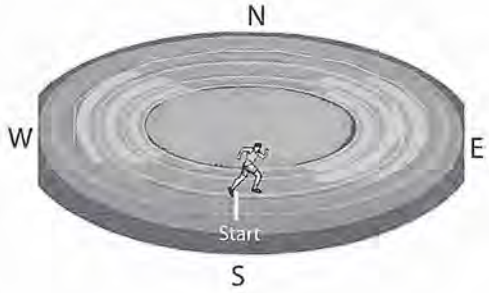
5 points/problem x 21 problems= 105 points(Max 100 points)

Exam ／[Total 100 点]

Number of Lab Reports	/3	Score

Homework	Score

The circular constant	$\pi = 3.14159...$
Mile	1 mile = 1609 m
Gravitational acceleration rate	$g = 9.80\ m/s^2$
The Density of Fresh Water	$1{,}000\ kg/m^3$
The Density of Sea Water	$1{,}025\ kg/m^3$
The Density of Ice	$917\ kg/m^3$
The Density of Air	$1.29\ kg/m^3$
The Density of Helium	$0.179\ kg/m^3$
Atmospheric Pressure	1 atm = 1013 hPa



(1) A jogger starts at the south end of a circular track whose radius is 41.0 m and runs on the track counterclockwise.

(1-a) Find the distance traveled and the displacement after the jogger has gone halfway around the track?

(1-b) Find the distance and displacement after a complete circuit of the track.

(Equations)

(a) $d = \frac{1}{2} 2\pi r = \frac{1}{2} \times 3.142 \times 41.0 = 128.8 \rightarrow 129$

$x = x_f - x_i = 41.0 \times 2 - 0 = 82.0$

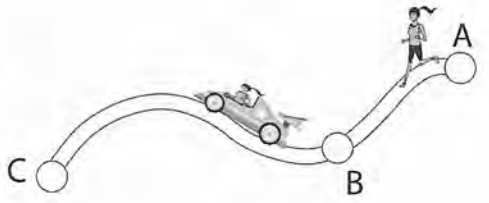
(b) $d = 2\pi r = 2 \times 3.142 \times 41.0 = 257.6 \rightarrow 258$

$x = x_f - x_i = 0 - 0 = 0$

(1-a) Answer	
Distance:	129 m
Displacement:	82.0 m to north
(1-b) Answer	
Distance:	258 m
Displacement:	0

(72%)

(2) You jog at 9.5 km/h for 8.0 km, then you jump into a car and drive an additional 16 km. With what average speed must you drive a car if your average speed for the entire 24 km is to be 22 km/h?



(Equations)

$t_1 = \frac{d_1}{v_1} = \frac{8.0 \text{ km}}{9.5 \text{ km/h}} = 0.842 \text{ h}$

$t_2 = \frac{d_2}{v_2} = \frac{16}{v_2}$

$v_{av} = \frac{24}{0.842 + \frac{16}{v_2}} = 22$

$\frac{24}{22} = 0.842 + \frac{16}{v_2}$

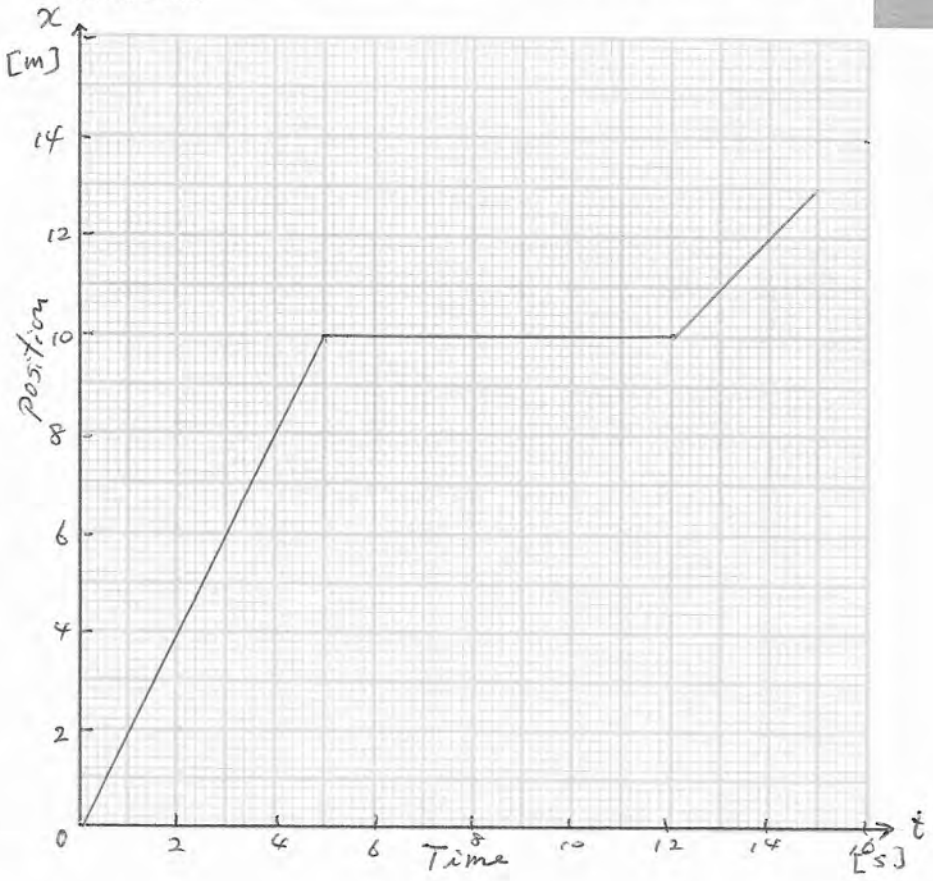
$\frac{16}{v_2} = 1.091 - 0.842 = 0.248$ one digit

$v_2 = \frac{16}{0.248} = 64.3 \text{ (km/h)} \rightarrow 60 \text{ (km/h)}$

(2) Answer	
	60 km/h

(33%)

(3) A parade float is at x=0 at time t=0. The float moves in a straight line at 2.0 m/s for the next 5.0 s before coming to a stop. After 7.0-s stop, the float moves again at 1.0 m/s in the same direction as before.
(3-a) Draw the position-time graph for the float from the time t = 0 until the time t = 15 s.
(3-b) From your graph, determine the position of the float at t = 2.0 s and t = 11s.



$v = 2.0\ m/s$ $0 \sim 5.0\ s$

$v = 0$ $(7.0\ s)$ $(5.0 \sim 12.0\ s)$

$v = 1.0\ m/s$ $7.0 \sim$

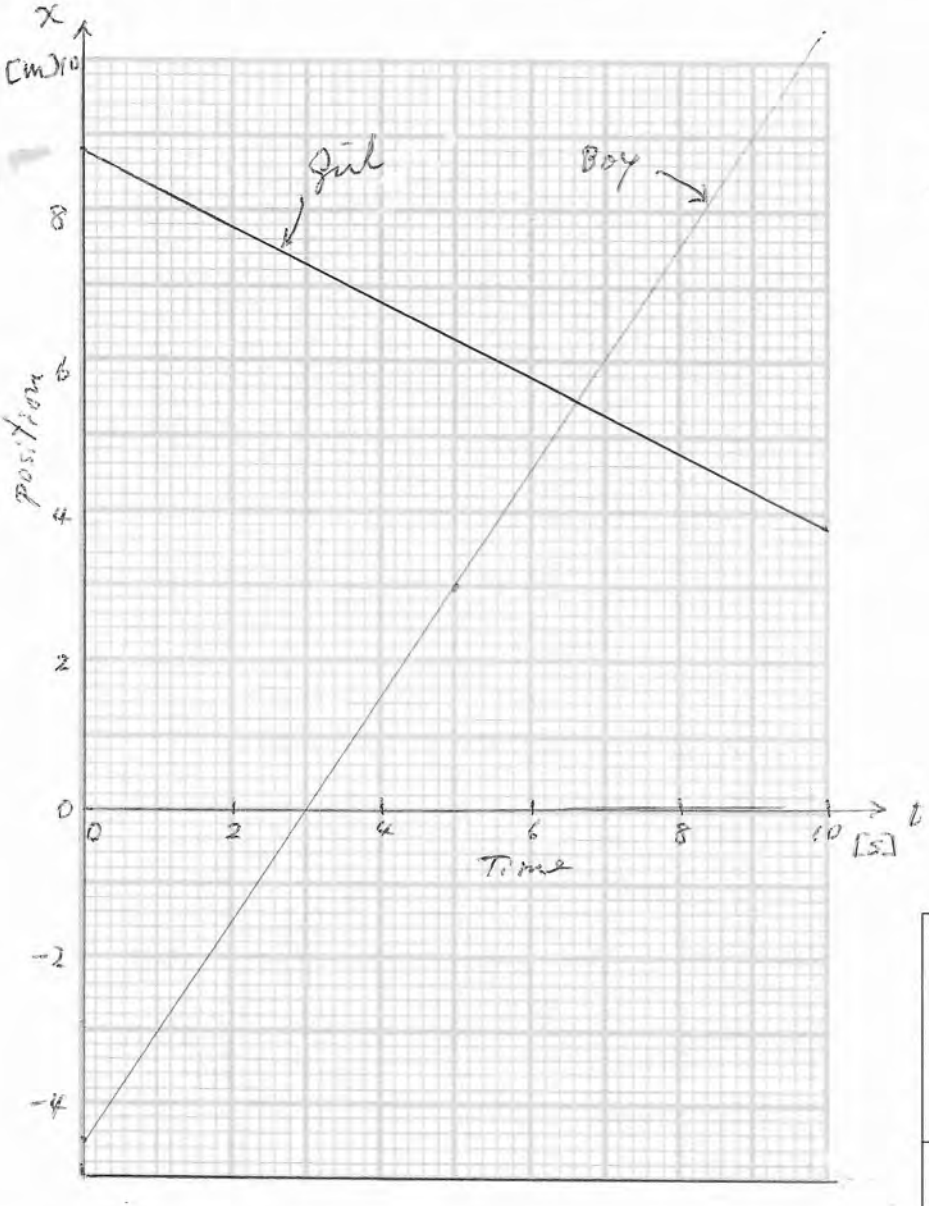
(3-a) Answer
Draw a graph
(3-b) Answer
t =2.0 s: 4.0 m
t = 11 s 10.0 m

(83%)

(Equations)

(4) A boy and a girl are riding bumper cars and moving on a straight track. At a time t = 0, the boy is located at 4.5 m west from the flag pole and moving at 1.5 m/s to east while the girl at 8.8m east from the pole and moving at 0.50 m/s to west.

(4-a) Write the position-time (x -t) equations of motion for the two cars from t = 0 to 10 s by setting up the origin at the flag pole and the positive direction of x axis to the east.
(4-b) Plot the two equations of motion on a position-time graph.
(4-c) At what time do the bumper cars collide?



$-4.5 + 1.5t = 8.8 - 0.50t$

$2.0t = 13.3$

$t = 6.650$

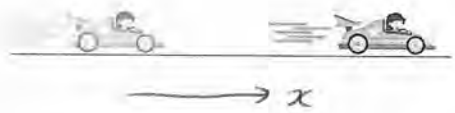
$\rightarrow 6.6$

(4-a) Answer Boy: $x = -4.5\,m + (1.5\,m/s)\,t$ Girl: $x = 8.8\,m + (-0.50\,m/s)\,t$
(4-b) Answer Draw a graph
(4-c) Answer 6.6 s

(65%)

11/1/2018 By Tohei Moritani..

(5) A car has an average acceleration of 6.24 m/s² to west for 0.300 s. At the end of this time its velocity is 9.31 m/s to east. What was the car's initial velocity?



(Equations)

$a = -6.24\ (m/s^2)$

$v = 9.31\ (m/s)$

$t = 0.300\ s$

$a = \frac{v - v_0}{t} \longrightarrow v_0 = v - at$

$= 9.31 - (-6.24) \times 0.300 = 9.31 + 1.872$

$= 11.182 \longrightarrow 11.18\ m/s$

(5) Answer: 11.18 m/s to East (27%)

(6) As you ride a bicycle with a speed of 6.4 m/s, a ball suddenly rolls out in front of you. You hit the brakes and come to rest in 3.8 m with constant acceleration. How much time does it take you to stop?

$v_0 = 6.4\ m/s \quad v = 0$

$x = 3.8\ m$

別解

$a = \frac{v - v_0}{t} = \frac{-6.4}{t}$ — ①

$x = v_0 t + \frac{1}{2} a t^2$

$3.8 = 6.4t + \frac{1}{2} a t^2$ — ②

①, ② $3.8 = 6.4t + \left(-\frac{1}{2} \frac{6.4}{t}\right) t^2$

$= 6.4t - 3.2t$

$= 3.2t$

$t = \frac{3.8}{3.2} = 1.19 \longrightarrow 1.2$ (5)

解

$x = \frac{1}{2}(v_i + v_f)\, t$

$t = \frac{2x}{v_i + v_f} = \frac{2 \times 3.8}{6.4 + 0}$

$= 1.1875 \longrightarrow 1.2$

(6) Answer: 1.2 s (63%)

(7) When a jumbo jet takes off, it runs at an acceleration rate of 2.2 m/s² and floats up off the runway at a speed of 93 m/s in case of a windless condition.
(7-a) How long does it take to float up off the runway after starting?
(7-b) How far does the jet run on the runway?
(Equations)

$v_0 = 0$, $v = 93$ m/s
$a = 2.2$ m/s²

$v = v_0 + at \rightarrow t = \dfrac{v - v_0}{a} = \dfrac{93 - 0}{2.2} = 42.3 \longrightarrow 42$ (s)

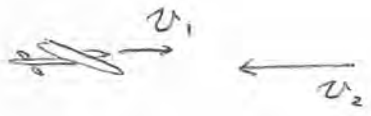
$v^2 - v_0^2 = 2ax$

$x = \dfrac{v^2 - v_0^2}{2a} = \dfrac{93^2 - 0}{2 \times 2.2} = 1986 \longrightarrow 2000$ (m)

(7-a) Answer
42 s
(7-b) Answer
2000 m

(76%)

(8) In case of a windy condition, a jet runs at an acceleration rate of 2.2 m/s² and floats up when its relative velocity to the air reaches 93 m/s. A jet is running toward windward in wind blowing at 15 m/s. (8-
(8-a) What is the speed of the jet relative to the ground when the jet floats up?
(8-b) How far does the jet run on the runway?



(a) $v = v_1 + v_2$
$= 93 + (-15) = 78$

(b) $x = \dfrac{v^2 - v_0^2}{2a}$

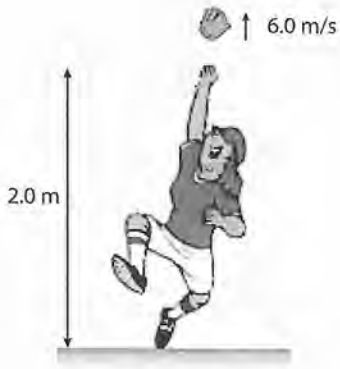
$= \dfrac{78^2 - 0}{2 \times 2.2}$

$= 1383 \longrightarrow 1400$

(8-a) Answer
78 m/s
(8-b) Answer
1400 m

(38%)

(9) To celebrate a victory, a pitcher throws her glove straight upward at 2.0 m above the ground with an initial speed of 6.0 m/s.



(9) How long does it take for the glove to reach its maximum height?

(10) How long does it take for the glove to return to the ground?

(11) Which graph best represents the motion of the glove when the velocity of the glove is recorded as a vertical axis, and time is recorded as a horizontal axis?

(Equations)

(9) $v = v_0 - gt$, $v = 0$

$$t = \frac{v_0}{g} = \frac{6.0}{9.8} = 0.612 \rightarrow 0.61\ (s)$$

(10)

$$y = v_0 t - \frac{1}{2} g t^2, \quad y = -2.0\ m$$

$$-2 = 6t - 4.9t^2$$

$$t^2 - 1.224t - 0.4082 = 0$$

$$t = \frac{1.224 \pm \sqrt{1.224^2 + 4 \times 0.4082}}{2}$$

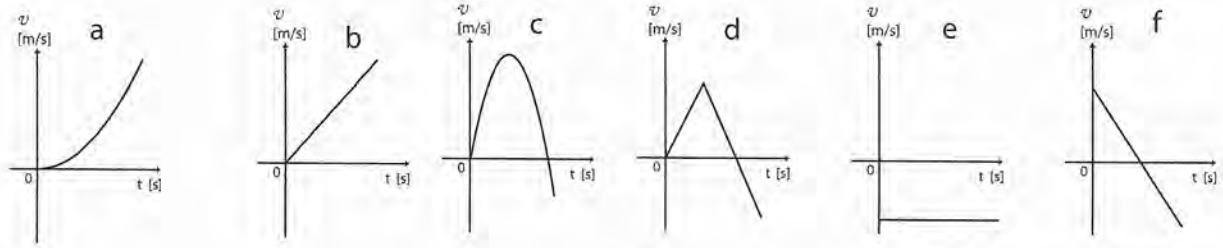
$$= 1.497$$

$$\rightarrow 1.5$$

(9) Answer: 0.61 s (81%)

(10) Answer: 1.5 s (24%)

(11) Answer: f (31%)



(12) A military helicopter on a training mission is flying horizontally at a speed of 80.0 m/s and accidentally drops a bomb at an elevation of 350.0 m. Ignore air resistance.
(12-a) How much time is required for the bomb to reach the earth?
(12-b) How far does it travel horizontally while falling?

(Equations)

(a) $y = \frac{1}{2} g t^2$

$$t = \sqrt{\frac{2y}{g}} = \sqrt{\frac{2 \times 350}{9.80}} = 8.452 \longrightarrow 8.45 \ (s)$$

(b) $x = v_0 t$

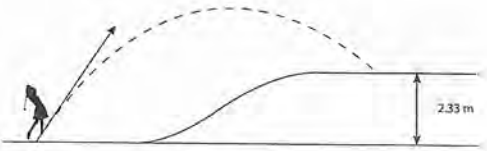
$$= 80.0 \times 8.452$$

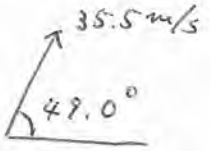
$$= 676.1 \longrightarrow 676 \ (m)$$

(12-a) Answer	
	8.45 s
(12-b) Answer	
	676 m

(66%)

(13) A golfer tees off at an initial speed of 35.5 m/s and at an angle of 49.0° above the horizontal toward a target 2.33 m high from the tee ground.
What is the horizontal distance the ball travels before it hit the ground? (Equations)





$v_{ox} = 35.5 \cos 49.0^\circ = 23.29 \ (m/s)$

$v_{oy} = 35.5 \sin 49.0^\circ = 26.79 \ (m/s)$

$y = v_{oy} t - \frac{1}{2} g t^2$

$2.33 = 26.79t - 4.9t^2$

$t^2 - 5.467t + 0.4755 = 0$

$t = \dfrac{5.467 \pm \sqrt{5.467^2 - 4 \times 0.4755}}{2}$

$= \dfrac{5.467 \pm 5.290}{2} = 5.379$ or 0.0885

0.0885 s is before the top.
5.379 s is suitable

$x = v_{ox} t$

$= 23.29 \times 5.379$

$= 125.3 \longrightarrow 125$

(13) Answer

125 m (37%)

(14) You are looking outside in a train traveling to the due south at a speed of 65 km/h. You see a commuter train that looks traveling on the neighboring rail backward at 12 km/h. What is the velocity of the commuter train?

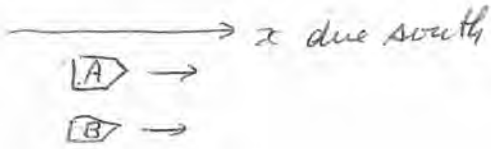
(Equations) A: my train B: Commuter train

$$v_{BA} = v_B - v_A$$

$$\rightarrow v_B = v_A + v_{BA}$$

$$= 65 + (-12)$$

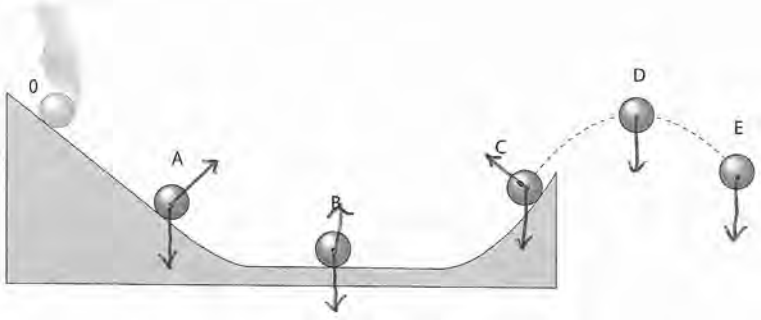
$$= 53 \ (km/h)$$



(14) Answer

53 km/h due south (48%)

(15) A ball is placed on a frictionless slope (0) and released, and then it shows a motion as shown by A→B→C→D→E in the figure. Draw arrows showing forces exerting on the ball in each stage A ~ E assuming the influence of air is negligible.



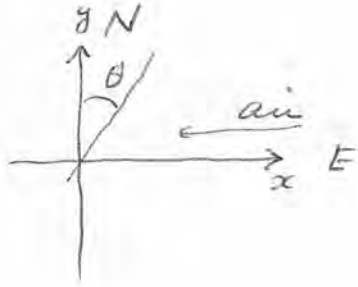
(15) Answer

Draw arrows inside the figure. (50%)

(16) The pilot of an airplane wants to fly due north but there is a 85 km/h wind blowing from east. In what direction should the pilot head her plane if its speed relative to the air is 335 km/h?

Equations

P: Plane A: Air



$$\vec{v} = \vec{v}_P + \vec{v}_A$$

$$0 = v_x = v_{Px} + v_{Ax}$$

$$= 335 \sin\theta - 85$$

$$\sin\theta = \frac{85}{335}$$

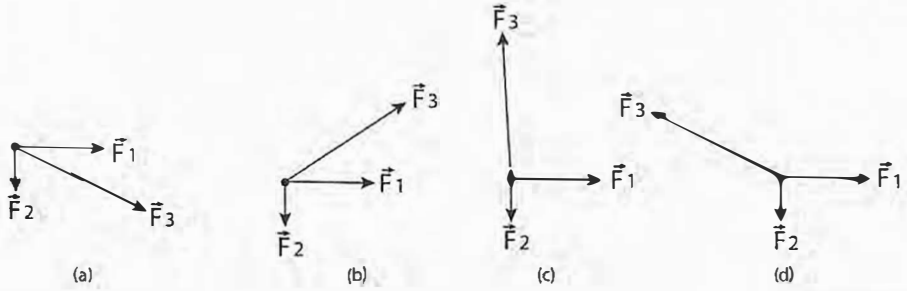
$$\theta = \sin^{-1}\left(\frac{85}{335}\right) = 14.70^\circ$$

$$\rightarrow 15^\circ$$

(16) Answer

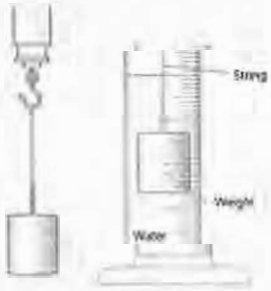
15° east from north (12%)

(17) The figure shows three forces, $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$ where the direction of $\vec{F}_3$ is different in (a), (b), (c) and (d). Which has the largest in magnitude for the net force of the three forces?



(17) Answer: a (62%)

(18) A weight is attached to a spring scale. When the weight is suspended in air, the scale reads 24.0 N; when it is completely immersed in water, the scale reads 19.9 N. (18-a) What is the volume of this weight?
(18-b) What is the density of the weight?
(Equations)



$F_b = 24.0 - 19.9 = 4.1\ (N)$

$F_b = \rho V g$

$V = \frac{F_b}{\rho g} = \frac{4.1}{1000 \times 9.80} = 4.18 \times 10^{-4}\ (m^3)$

$\rightarrow 4.2 \times 10^{-4}\ (m^3)$

$m = \frac{24.0}{g} = \frac{24.0}{9.80} = 2.449\ (kg)$

$\rho' = \frac{m}{V} = \frac{2.449}{4.18 \times 10^{-4}} = 5854$

$\rightarrow 5900$

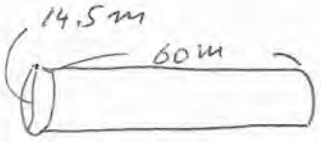
(18-a) Answer: $4.2 \times 10^{-4}\ m^3$

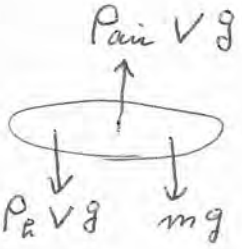
(18-b) Answer: $5900\ kg/m^3$ (36%)

(19) "Der Grosse Fuji" is an airship using helium gas. If the size is approximated as a column having a diameter of 14.5 m and a length of 60.0 m, what is the maximum mass the airship can lift including its mass?
(Equations)

$$V = \left(\frac{14.5}{2}\right)^2 \pi \times 60$$

$$= 9909 \ m^3$$





$$\rho_{air} V g = \rho_{He} V g + m g$$

$$m = V(\rho_{air} - \rho_{He})$$

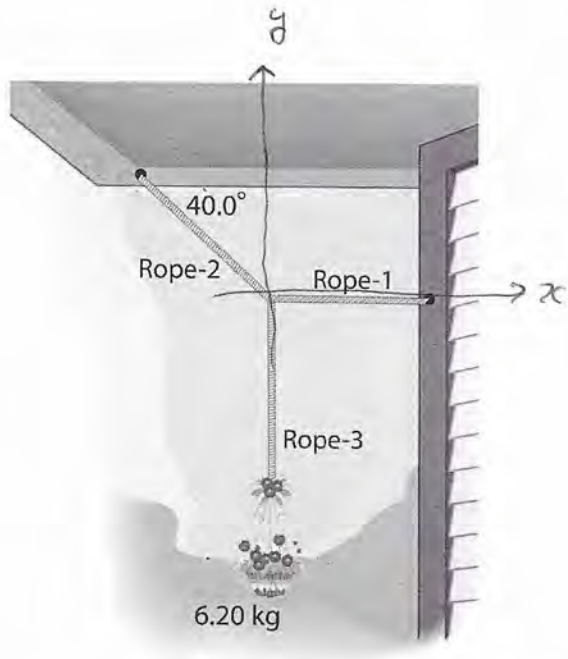
$$= 9909\,(1.29 - 0.179)$$

$$= 11{,}008 \ kg \longrightarrow 11.0 \ t$$

(19) Answer
11.0 t

(10%)

(20) To hang a 6.20 kg pot of flowers, a gardener uses three ropes – one attached horizontally to a wall, the second sloping upward at an angle 40.0° and attached to a ceiling, and the third hanging the flower basket. Find the tension in each rope.



$$\vec{T}_1 + \vec{T}_2 + \vec{T}_3 = 0$$

$$T_{1x} + T_{2x} + T_{3x} = 0$$

$$T_1 - T_2 \cos 40^\circ + 0 = 0 \quad \text{— ①}$$

$$T_{1y} + T_{2y} + T_{3y} = 0$$

$$0 + T_2 \sin 40^\circ - T_3 = 0 \quad \text{— ②}$$

$$T_3 = 6.20 \times 9.80 = 60.76\ (N) \quad \text{— ③}$$

$$\rightarrow 60.8\ N$$

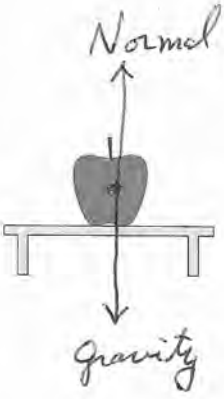
③: $T_2 = \dfrac{T_3}{\sin 40^\circ} = \dfrac{60.76}{\sin 40^\circ} = 94.53 \rightarrow 94.5\ (N)$

①: $T_1 = T_2 \cos 40^\circ = 94.53 \cos 40^\circ = 72.41 \rightarrow 72.4\ (N)$

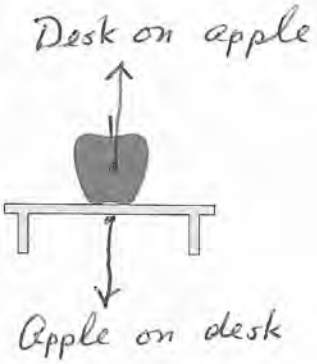
(20) Answer		
Rope1	72.4	N
Rope2	94.5	N
Rope3	60.8	N

(43%)

(21) In the following two figures, draw force vectors and explain each of them.



(a) Two forces in equilibrium



(b) Two forces in the relation of action-reaction

(72%)