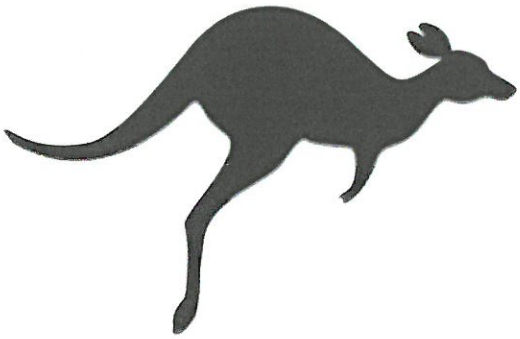
	Total	K+E	I+O
Students	37	19	18
Average	29.2/50	29.2/50	29.1/50
Best	45/50	45/50	44/50

11th Physics (2017 – 18)

(1stQ, #1 Mini Test)

Class	No.	Name Solution



In calculation problems, describe equations clearly and systematically enough to show how to solve the problems.

Gravitational acceleration rate $g = 9.80\ m/s^2$

4 pt/question x 13 questions = 52 pt Max 50 pt

／[Total 50 pt]

9/21/2017 By Tohei Moritani

(1) A kangaroo runs at a speed of 65 km/h.
(1-a) How far can the kangaroo hop in 3.2 min at this speed?
(1-b) How long will it take the kangaroo to hop 0.25 km at this speed?
Equations

$65\ \frac{km}{h} \times \frac{10^3\ m}{1\ km} \times \frac{1\ h}{3.6\times10^3\ s} = \frac{65}{3.6}\ \frac{m}{s} = 18.06\ m/s$ ← 2 digits ; +1

(a) $d = vt = 18.06 \times 3.2 \times 60 = 3468 \rightarrow 3500\ m = 3.5\ km$

(b) $t = \frac{d}{v} = \frac{0.25 \times 10^3\ m}{18.06\ m/s}$ ← 2 digits ← 2 digits

$= \frac{250\ m}{18\ m/s} = 13.9 \rightarrow 14\ s$

(1-a) Answer	3.5 km
(1-b) Answer	14 s

(79%)

or 0.23 min

(2) A finch rides on the back of a Galapagos tortoise, which walks at the steady pace of 0.060 m/s. After 1.2 min, the finch tires of the tortoise's slow pace, and takes flight in the same direction for another 1.2 min at 12 m/s. What was the average speed of the finch for this 2.4-min interval?
Equations

$x_1 = 0.060\ m/s \times 1.2\ min \times 60\ s/min$

$= 4.32\ m$ ← ②

$x_2 = 12\ m/s \times 1.2\ min \times 60\ s/min$

$= 864.00\ m$

$x_1 + x_2 = 868.32$

864.00
4.32
868.32

$v = \frac{x_1 + x_2}{t} = \frac{868.32}{2.4\times60} = 6.03 \rightarrow 6.0$ ← ② ; ③

$\left(v_{av} = \frac{0.060 + 12}{2} = 6.03 \right)$ also OK in this case

(2) Answer	6.0 m/s

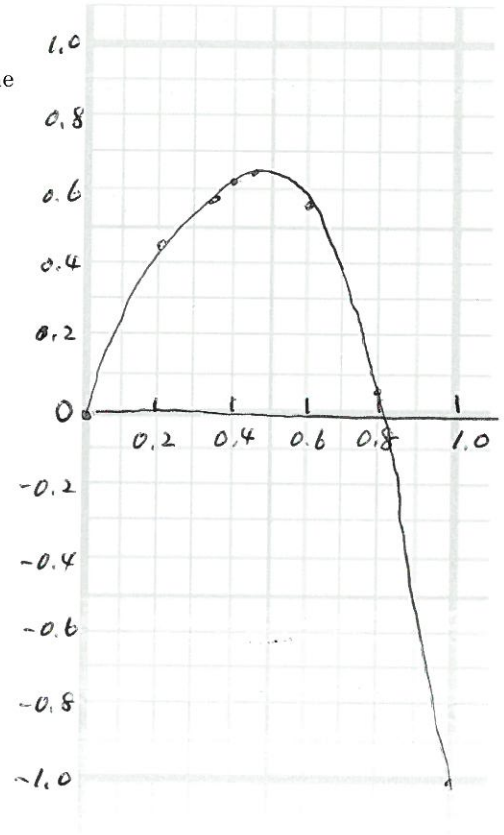
(56%)

or 360 m/min

(3,4,5) The position of a particle as a function of time is given by the following table.

t [s]	x [m]
0	0
0.2	0.376
0.35	0.571
0.4	0.608
0.45	0.627
0.6	0.552
0.8	0.064
1.0	-1.000

(3-a) Plot x versus t for time from $t = 0$ to $t = 1.0$ s.



(3-b) Find the average velocity for the particle from $t = 0$ to $t = 1.0$ s.

(4) Estimate the instantaneous velocity at $t = 0.40$ s.

Equations

(b)

$$v_{av} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i}$$

$$= \frac{-1.000 - 0}{1.00 - 0} = -1.000 \rightarrow -1.00$$

(3) (3)

(c) $v \approx v_{av} = \frac{\Delta x}{\Delta t}$

$$= \frac{x_f - x_i}{t_f - t_i}$$

$$= \frac{0.627 - 0.571}{0.45 - 0.35}$$

$$= \frac{0.056}{0.10}$$

$$= 0.560 \rightarrow 0.56$$

(3-a) Answer Draw a graph	
(3-b) Answer	-1.00 m/s (71%)

(4) Answer	0.56 m/s (5%)

(5,6) Landing with a speed of 81.9 m/s, and traveling due south, a jet comes to rest in 949 m. Assume the jet slows with constant acceleration.

(5) Find the magnitude and direction of its acceleration.

(6) Find how long does it take from landing to rest.

Equations

$v_0 = 81.9$ m/s , $v = 0$

$x = 949$ m

(5) $v^2 - v_0^2 = 2ax$

$= \dfrac{v^2 - v_0^2}{2} = \dfrac{0 - 81.9^2}{2 \times 949}$

$= -3.534 \longrightarrow -3.53$ (m/s²)

(5) Answer: 3.53 m/s² due north (49%)

(6) $v = v_0 + at$

$t = \dfrac{v - v_0}{a} = \dfrac{0 - 81.9}{-3.534} = 23.17$

$\longrightarrow 23.2$ (s)

(6) Answer: 23.2 s (49%)

(7) Running with an initial velocity of +11.3 m/s, a horse has an average acceleration of -1.81 m/s2. How long does it take for the horse to decrease its velocity to +6.52 m/s?

Equations

$v_i = +11.3$ m/s , $v_f = +6.52$ m/s

$a = -1.81$ m/s²

$a = \dfrac{v_f - v_i}{t}$

$t = \dfrac{v_f - v_i}{a}$

$= \dfrac{6.52 - 11.3}{-1.81}$

$= \dfrac{-4.78}{-1.81}$ (2 digits / 3 digits)

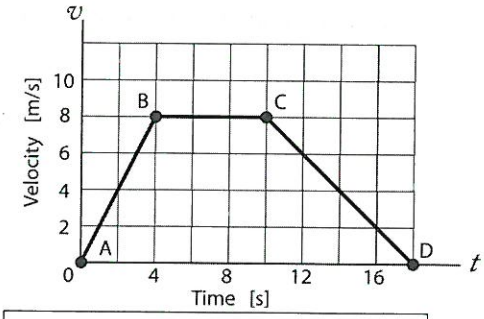
$= 2.64 \longrightarrow 2.6$ (s)

11.3 − 6.52 = 4.78

(7) Answer: 2.6 s (65%)

(6-a) Answer

(8) What is the acceleration for each graph segment, A-B, B-C and C-D, in the graph?
Equations



A-B $a = \frac{v_f - v_i}{t_f - t_i} = \frac{8.0 - 0}{4.0 - 0} = 2.0 \ (m/s^2)$

B-C $a = \frac{v_f - v_i}{t_f - t_i} = \frac{8.0 - 8.0}{10.0 - 4.0} = 0$

C-D $a = \frac{v_f - v_i}{t_f - t_i} = \frac{0 - 8.0}{18.0 - 10.0}$

$= \frac{-8.0}{8.0} = -1.0 \ (m/s^2)$

(8) Answer

A-B	2.0	m/s^2
B-C	0	
C-D	-1.0	m/s^2

(75%)

(9, 10) A car accelerates from rest at a constant acceleration of 2.0 m/s^2 for 5.0 s.
(9) What is the speed of the car at the end of that time?
(10 How far does the car travel in this time?

$v_i = 0$

$a = 2.0 \ m/s^2$

$t = 5.0 \ s$

(9) $v = v_0 + at$

$= 0 + 2.0 \times 5.0 = 10.0$

$\longrightarrow 10$

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

$= 0 + \frac{1}{2} \times 2.0 \times 5.0^2$

$= 25.0 \longrightarrow 25$

(9) Answer

10 m/s

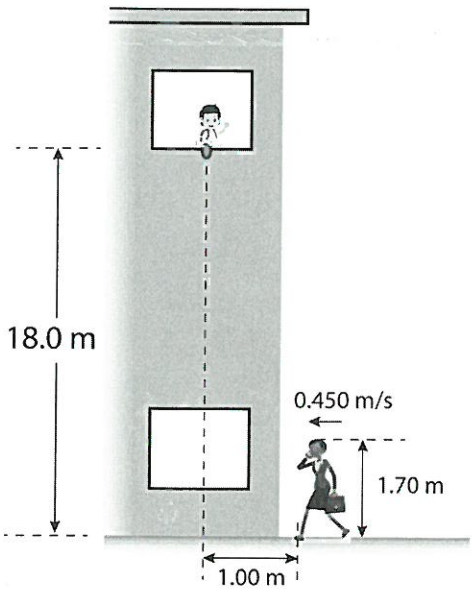
(84%)

(10) Answer

25 m

(61%)

(11) A student at a window on the second floor of a dorm sees his math professor walking on the sidewalk beside the building. He drops a water balloon from 18.0 m above the ground when the professor is 1.00 m from the point directly beneath the window. If the professor 170 cm tall and walks at a rate of 0.450 m/s, does the balloon hit her? If not, how close does it come?



Equations

Balloon $y = \frac{1}{2} g t^2$

Head $t = \sqrt{\frac{2y}{g}} = \sqrt{\frac{2(18.0 - 1.70)}{9.80}} = 1.8239\,(s)$ (3 digits)

Foot $t = \sqrt{\frac{2y}{g}} \sqrt{\frac{2 \times 18.0}{9.80}} = 1.9166\,(s)$

Professer distance

Head $x = vt = 0.450 \times 1.8239 = 0.8207 \to 0.821$ $\Delta d = 1.00 - 0.821 = 0.179 \to 0.18\,(m)$

Foot $x = vt = 0.450 \times 1.9166 = 0.8622 \to 0.862$ $\Delta d = 1.00 - 0.862 = 0.138 \to 0.14\,(m)$

Professer time

$t' = \frac{1.00}{0.450} = 2.222 \to 2.22\ s$

Head $\Delta t = t' - t = 2.222 - 0.821 = 1.401 \to 1.40\,(s)$

Foot $\Delta t = t' - t = 2.222 - 0.862 = 1.360 \to 1.36\,(s)$

* It falls 1.40 s or 1.36 s before her head or foot reaches the drop point, respectively.

(11) Answer

No, the balloon does not hit her.

It falls 0.18 m ahead from her head and 0.14 m ahead from her foot.

(56 %)

(12-13) An entertainer is learning to juggle balls thrown very high. One of the balls is thrown vertically upward from 1.80 m above the ground with an initial velocity of 4.90 m/s.
(12) When does the ball reach its highest point?
(13) If he fails to catch the ball and it hits the ground, how long is it in the air?
Equations

(12) $v = v_0 - gt$, $v = 0$ ③

$t = \frac{v_0}{g} = \frac{4.90}{9.80} = 0.5000$ ③ ③

$\rightarrow 0.500$

(13) $y = v_0 t - \frac{1}{2} g t^2$

$-1.80 = 4.90t - \frac{1}{2} \times 9.80 \times t^2 \rightarrow t^2 - t - 0.3673 = 0$

$t = \frac{1.00 \pm \sqrt{1.00^2 + 4 \times 0.3673}}{2.00} = \frac{1.00 \pm 1.5714}{2.00} = 1.2857$

$\rightarrow 1.29$ (s)

Another solution

(13) $y' = v_0 t' - \frac{1}{2} g t'^2$ ③ ③ ③

$= 4.90 \times 0.5000 - 4.90 \times 0.5000^2 = 2.450 - 1.225 = 1.225$

$1.225 + 1.80 = 3.025$ ③

Free Fall $t = \sqrt{\frac{2y'}{g}} = \sqrt{\frac{2 \times 3.025}{9.80}} = 0.7859$ (s) ③

③ ③

$0.7857 + 0.5000 = 1.285$

(Q12) Answer
0.500 s (59%)

(Q13) Answer
1.29 s (20%)

Your opinions

If you need my extra help, come to Physics Room early in the morning.

(The solution will be shown on the Website of Physic Class tonight.