Science 10

SA Physics #3 – June 6, 2018

Name - Key

Part 1 – Terms and Definitions (Value – 10)

Complete each statement using a word (from the list below) that makes the statement true. There are extra words in the list.

~~reference~~	~~direction~~	vector
~~displacement~~	~~speed~~	~~scalar~~
~~speed up~~	position	slow down
~~acceleration~~	~~distance~~	~~magnitude~~

1. A vector quantity has both magnitude and direction.

2. The change in an object's position is its displacement. ($\vec{\Delta d}$)

3. A reference point can be called a starting point.

4. The rate of change of velocity is called acceleration. ($\frac{\vec{\Delta v}}{t}$)

5. Distance is the amount of space between two objects or points.

6. A scalar quantity has only magnitude.

7. Speed is how fast an object is moving.

8. The separation and direction of an object from a reference point is called its position. ($\vec{d}$)

9. If the velocity and acceleration of an object have the same directions, the object will speed up.

10

Part 2 – Physical Quantities (Value – 15)

1. Complete the chart below. Choices are provided in some of the headers. (9)

Physical Quantity	Type of Physical Quantity (scalar or vector)	Variable	Unit (s, m, m/s, m/s²)
position	vector	$\vec{d}$	m
constant velocity	vector	$\vec{v}$	m/s
average speed	scalar	v_{av}	m/s
acceleration	vector	$\vec{a}$	m/s²
distance	scalar	d	m
time	scalar	t	s

2. a) Using **B** as your reference point, state the position of each point below. Include signs to indicate directions: + for a positive direction and – for a negative direction. No units are required in this case. (2)

(i) **A** $\vec{d}$ = +4 (ii) **C** $\vec{d}$ = −11

b) If an object moves from **A** to **C**, what is the object's displacement? Show a calculation. A word statement is not required. *Consult your formula sheet if required. (4)

$A \rightarrow \vec{d_i} = +4$

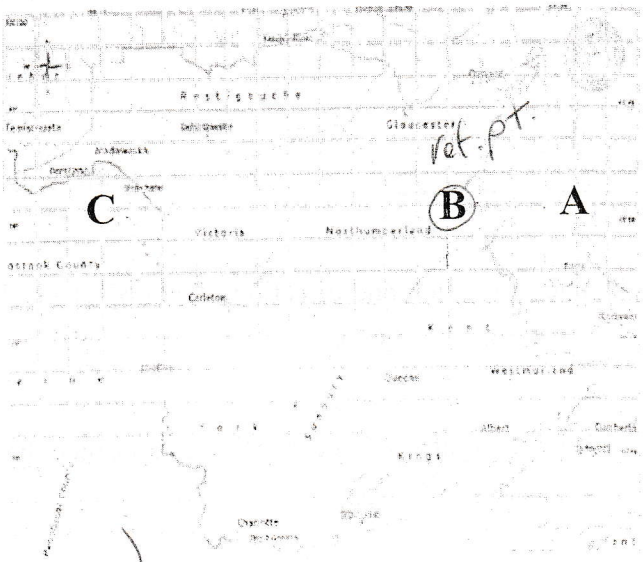
$B \rightarrow$ ref. point

$C \rightarrow \vec{d_f} = -11$

$\Delta\vec{d} = \vec{d_f} - \vec{d_i}$

$\Delta\vec{d} = -11 - (+4)$

$\Delta\vec{d} = -15$



(C is 15 blocks to the left of A.)

* Formula Sheet → Use It!

Part 3 – Word Problems (Value - 29)

Solve these problems in the space provided. Use the problem solving steps discussed in class to obtain full value.

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1. A car is moving south at a constant velocity of 90.0 km/h along a straight highway. Find the the displacement of the car after 1.25 hours. (8)

$\Delta\vec{d} = ?$

$\vec{v} = -90.0\ \frac{km}{h}$

$t = 1.25\ h$

$\vec{v} = \frac{\Delta\vec{d}}{t}$

$\Delta\vec{d} = \vec{v}\,t$ — 3SD — 3SD

$\Delta\vec{d} = \left(-90.0\ \frac{km}{h}\right)(1.25\ h)$

$\Delta\vec{d} = -113\ km$ — 3SD

The displacement was 113 km. South.

2. After accelerating uniformly for 12.8 s, an object with an initial velocity of 4.0 m/s [E] reaches a final velocity of 7.1 m/s [E]. What was the acceleration of the object? (6)

$\vec{a} = ?$

$t = 12.8\ s$

$\vec{v}_i = +4.0\ m/s$

$\vec{v}_f = +7.1\ m/s$

$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$ — 2SD — 2SD

$\vec{a} = \frac{\left(+7.1\ \frac{m}{s}\right) - \left(+4.0\ \frac{m}{s}\right)}{12.8\ s}$ — 3SD

$\vec{a} = +0.24\ m/s^2$ — 2SD

The acceleration of the object was $0.24\ m/s^2$ [E].

3. Maggie is walking with an average velocity of 4.2 m/s south. How long will it take her to go 110 m south? (8)

$t = ?$

$\vec{v}_{av} = -4.2 \text{ m/s}$

$\Delta \vec{d}_r = -110 \text{ m}$

$\vec{v}_{av} = \dfrac{\Delta \vec{d}_r}{t}$

$t = \dfrac{\Delta \vec{d}_r}{\vec{v}_{av}}$ 3s1)

$t = \dfrac{-110 \text{ m}}{-4.2 \text{ m/s}}$ 2s1)

$t = 26 \text{ s}$ 2s1)

It would take Maggie 26 s

4. A motorbike traveling north accelerates uniformly with an acceleration of 1.34 m/s^2 north along a straight road. What was the initial velocity of the motorbike after accelerating for 16 s if its final velocity was 31 m/s north? (7)

$\vec{v}_i = ?$

$\vec{a} = +1.34 \text{ m/s}^2$

$t = 16 \text{ s}$

$\vec{v}_f = +31 \text{ m/s}$

$\vec{a} = \dfrac{\vec{v}_f - \vec{v}_i}{t}$

$\vec{v}_f = \vec{v}_i + \vec{a}t$

$\vec{v}_f - \vec{a}t = \vec{v}_i$ 3s1) 2s1)

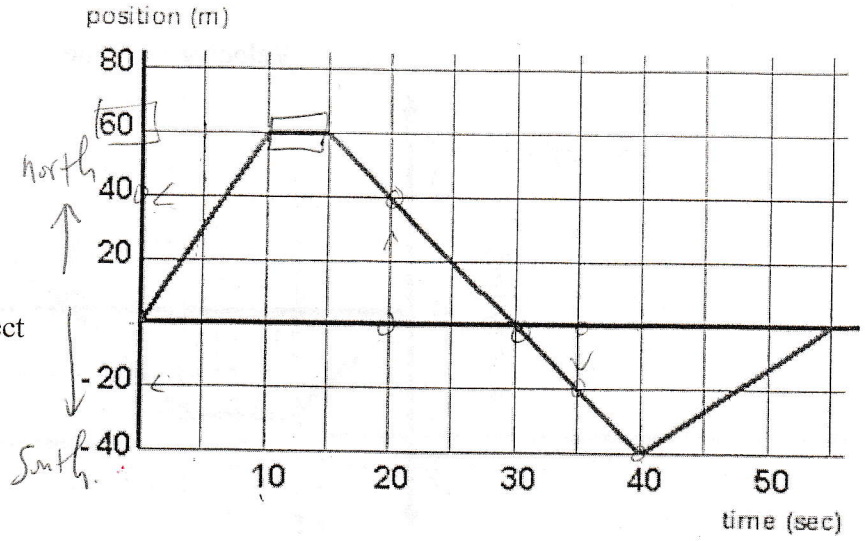
2s1) $\left(+31 \dfrac{\text{m}}{\text{s}}\right) - \left(+1.34 \dfrac{\text{m}}{\text{s}^2}\right)(16 \text{ s}) = \vec{v}_i$

$\vec{v}_i = +9.6 \dfrac{\text{m}}{\text{s}}$ 2s1)

The initial velocity of the motorbike was $9.6 \dfrac{\text{m}}{\text{s}}$, north.

Part 4 – Graphs (Value – 27)

1. Answer the questions below using the position versus time graph provided for a cart traveling in a straight line. Assume the positive direction is north.



a) What is the position of the object
(i) at t = 20 s? (1)
40m, north.
(ii) at t = 35 s? (1)
20m, South.

b) During which time interval did the cart first travel in a negative direction? Circle the correct time interval below. (1)

0 – 10 10 – 15 (15 – 30) 30 – 40 40 - 55

c) What was the maximum displacement of the object? (1)
60m, north.

d) What was the total distance traveled by the cart? (1)
60m + 60m + 40m + 40m = 200 m.

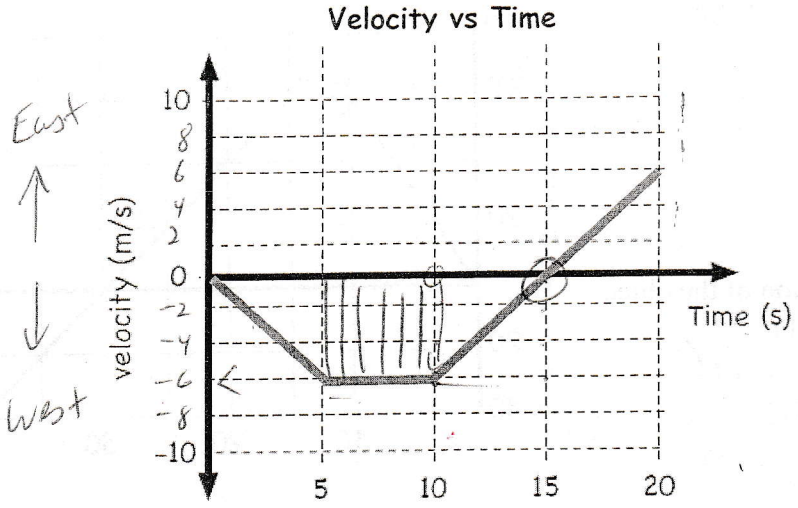
e) What type of motion (uniform or uniformly accelerated) did the object have between t = 30 s and t = 40 s? (1)
Constant Slope → Constant velocity → Uniform motion

f) What was the velocity of the cart between 10 s and 15 s? (1)
Slope $\vec{v} = \frac{\text{rise}}{\text{run}} = \frac{0m}{5s} = 0 m/s.$

g) What was the velocity of the cart between 0 s and 10 s? Show a calculation. Report your answer to 2 significant digits. (3)
Slope $\vec{v} = \frac{+60m}{10s.} = +6.0 m/s.$ or 6.0m/s, north.

h) What was the velocity of the cart between 30 s and 40 s? Show a calculation. Report your answer to 2 significant digits. (3)
Slope $\vec{v} = \frac{-40m}{10s} = -4.0 m/s$ or 4.0m/s, South.

2. Answer the questions below using the velocity versus time graph provided for an object traveling in a straight line. Assume the positive direction is east.



a) What is the velocity of the object at t = 10 s? (1)

6 m/s, west

b) (i) What type of motion (uniform or uniformly accelerated) does the object have between t = 0 s and t = 5s? uniformly acc'd (1) (velocity is changing)

(ii) What type of motion (uniform or uniformly accelerated) does the object have between t = 5 s and t = 10 s? uniform motion (1) (velocity is constant)

c) Did the object change direction? If so, when? (1)

Yes, at $t = 15$ s.

d) What is the acceleration of the object between t = 10 s and t = 15 s? Show a calculation and express your answer to 2 SDs. (3)

slope $\vec{a} = \frac{\text{rise}}{\text{run}} = \frac{-6.0\text{ m/s}}{5\text{ s}} = -1.2\ \frac{\text{m}}{\text{s}^2}$ or $1.2\ \text{m/s}^2$, west

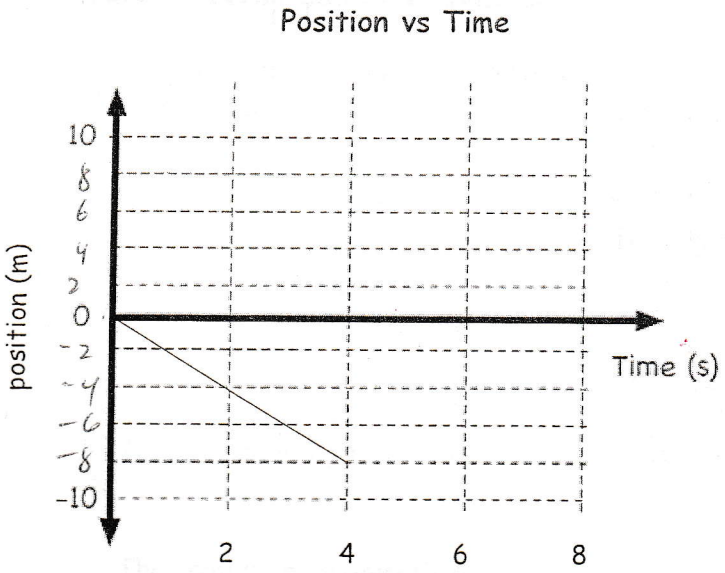
e) What was the displacement of the object between t = 5 s and t = 10 s? Show a calculation and express your answer to 2 SDs. (3)

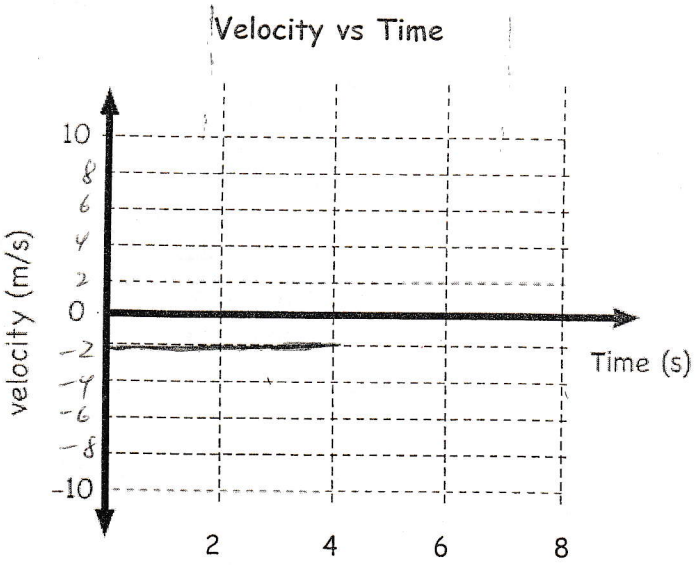
area $\Delta\vec{d} = (5\text{ s})\left(-6\ \frac{\text{m}}{\text{s}}\right) = -30\text{ m}$ or 30 m, west

3. Draw the velocity-time graphs for an object whose motion produced the position-time graphs provide. (4)

Calculate slope of P/t graph to get velocity.

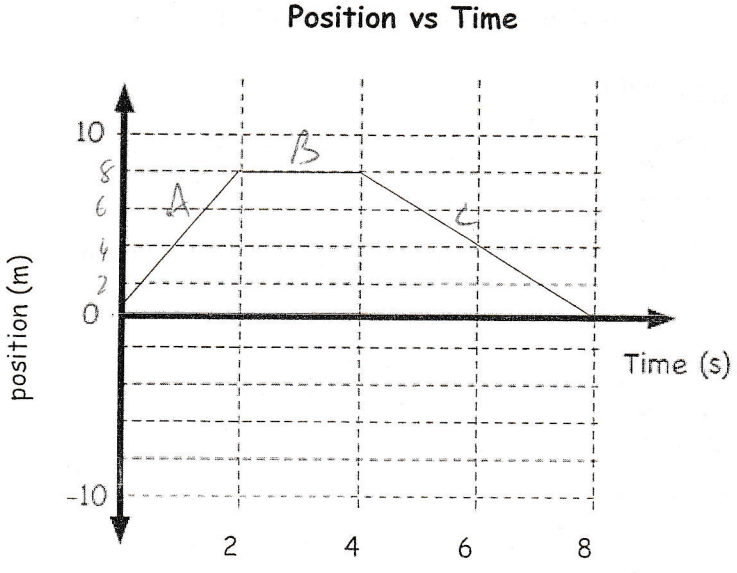
a)

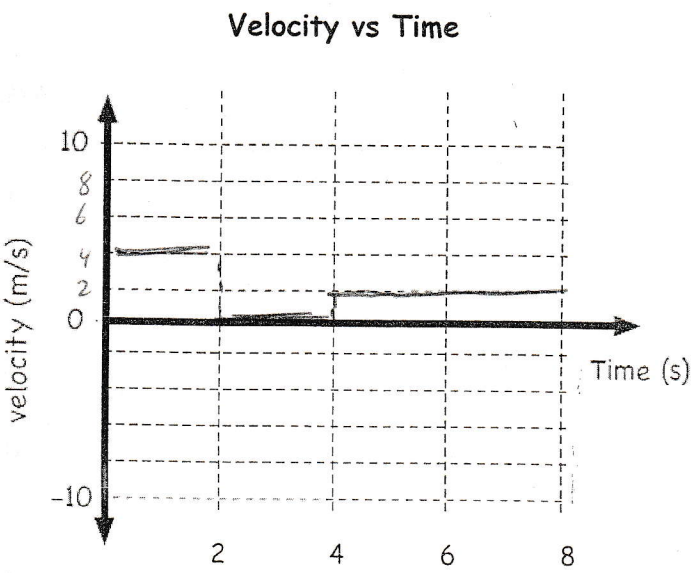




$\vec{v} = \frac{\text{rise}}{\text{run}} = \frac{-8m}{4s} = -2\frac{m}{s}$

b)





A → $\vec{v} = \frac{8m}{2s} = 4\ m/s$

B → $\vec{v} = 0\ m/s$

C → $\vec{v} = \frac{8m}{4s} = 2\ m/s$