

أوراق عمل وتدريبات درس التسارع



تم تحميل هذا الملف من موقع المناهج الإماراتية

موقع المناهج ← المناهج الإماراتية ← الصف التاسع ← فيزياء ← الفصل الأول ← ملفات متنوعة ← الملف

تاريخ إضافة الملف على موقع المناهج: 08:46:31 2026-10-14

ملفات اكتب للمعلم اكتب للطالب ا اختبارات الكترونية ا اختبارات ا حلول ا عروض بوربوينت ا أوراق عمل
منهج انجليزي ا ملخصات وتقارير ا مذكرات وبنوك ا الامتحان النهائي ا للمدرس

المزيد من مادة
فيزياء:

إعداد: إسلام سالم

التواصل الاجتماعي بحسب الصف التاسع



صفحة المناهج
الإماراتية على
فيسبوك

المزيد من الملفات بحسب الصف التاسع والمادة فيزياء في الفصل الأول

تحميل تطبيق المناهج للهواتف الذكية

تطبيق المناهج على Play Google (أندرويد)

تطبيق المناهج على Store App (آبل)

ماكس بلانك

في الفيزياء



“

الفيزياء ليست مجرد معادلات ...

بل هي اللغة التي يفهم بها الكون نفسه”

”



Mr Eslam Salem Eltwaab
— Physics —

Chapter 3 :- acceleration

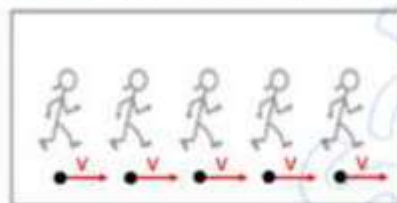
First semester 2026-2027

Section 3.1 acceleration

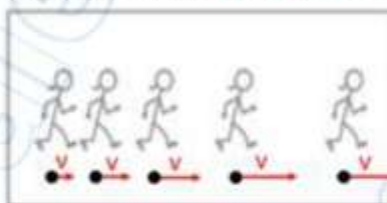
Uniform and nonuniform motion:

An object's motion can be **uniform** or **nonuniform**.

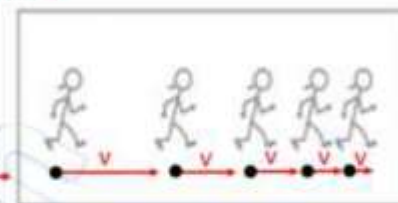
Nonuniform motion means that the object is experiencing a **change in its velocity**



Uniform motion
Object moving at
constant speed



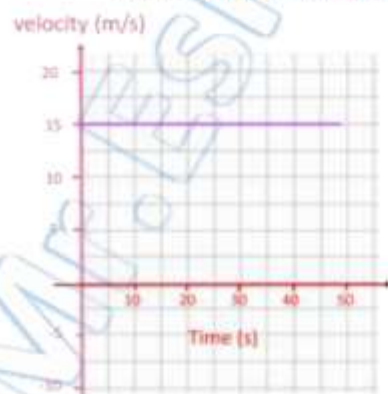
nonuniform motion
Object accelerating



nonuniform motion
Object decelerating

Velocity time graphs

- To visualize the change in velocity of an object, we can use **velocity-time graphs**.
- We plot **time** on the **x-axis** and **velocity** on the **y-axis**.

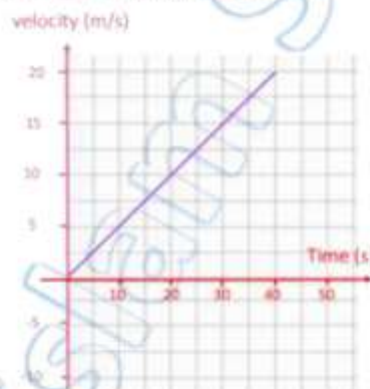


How much is the velocity of the object at

- $t = 10 \text{ s}$
- $t = 20 \text{ s}$
- $t = 30 \text{ s}$

What can you say about the velocity of the object ?

Is the object moving right or left ? Why?



How much is the velocity of the object at

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- $t = 30 \text{ s}$

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How much is the velocity of the object at

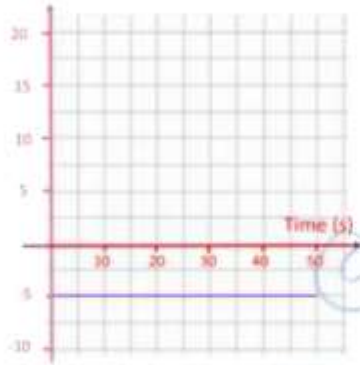
- $t = 10 \text{ s}$
- $t = 20 \text{ s}$
- $t = 30 \text{ s}$

What can you say about the velocity of the object ?

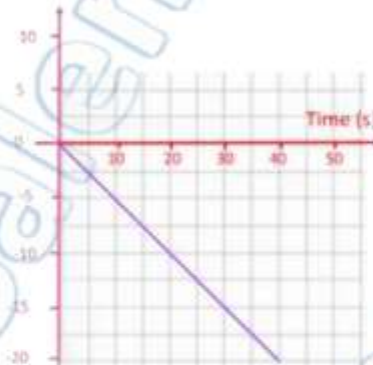
Is the object moving right or left ? Why?

Velocity –time graph

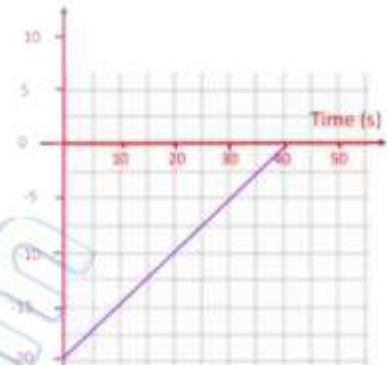
velocity (m/s)



velocity (m/s)



velocity (m/s)



How much is the velocity of the object at

4. $t = 10$ s
5. $t = 20$ s
6. $t = 30$ s

What can you say about the velocity of the object ?

Is the object moving right or left ? Why?

How much is the velocity of the object at

7. $t = 10$ s
8. $t = 20$ s
9. $t = 30$ s

What can you say about the velocity of the object ?

Is the object moving right or left ? Why?

How much is the velocity of the object at

10. $t = 10$ s
11. $t = 20$ s
12. $t = 30$ s

What can you say about the velocity of the object ?

Is the object moving right or left ? Why?



كيف نعرف حركة الجسم من منحنى (السرعة – الزمن)؟

من شكل أتخط في منحنى السرعة–الزمن نحدد هل الجسم يتسارع أم يتباطأ؟



القاعدة الأساسية

إذا كان ميل الخط (الممنحنى) موجباً ← يتسارع
 إذا كان ميل الخط (الممنحنى) سالباً ← يتباطأ
 (الميل = التغير في السرعة ÷ التغير في الزمن)

يتسارع

- خط مستقيم مائل للأعلى
- السرعة تزداد مع الزمن

يتحرك بسرعة ثابتة

- خط أفقي
- السرعة لا تتغير مع الزمن

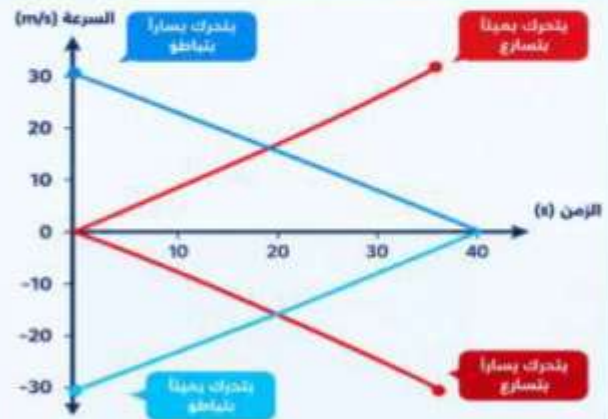
يتباطأ

- خط مستقيم مائل للأسفل
- السرعة تقل مع الزمن

ساكن

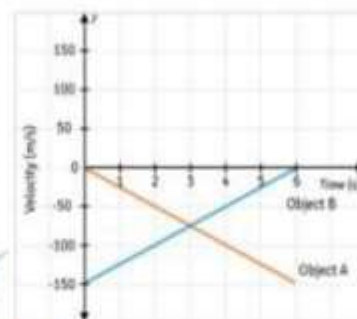
- خط أفقي على محور الزمن
- السرعة تساوي صفراً

مثال على منحنى (السرعة – الزمن)

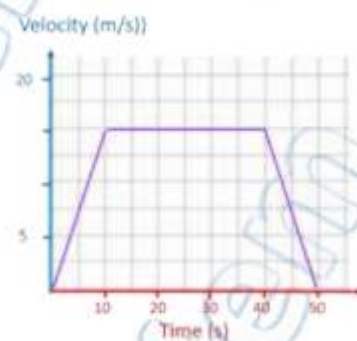


Velocity-time graph

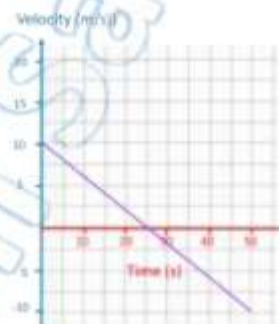
Which object is speeding up and which is slowing down?



Describe what is happening to a car's velocity and direction of motion for the following velocity time graph



Describe what is happening to a car's velocity and direction of motion for the following velocity time graph

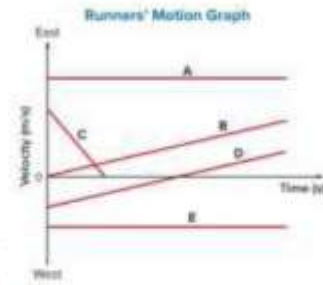


Describe what is happening to a car's velocity and direction of motion for the following velocity time graph



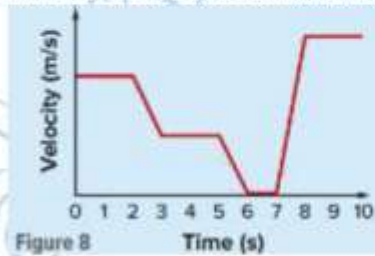
Velocity–time graph

Which object is speeding up and which is slowing down?



Describe what is happening to a car's velocity and direction of motion for the following velocity time graph

- (0–2) s →
- (2–3) s →
- (3–5) s →
- (5–6) s →
- (6–7) s →
- (7–8) s →
- (8–10) s →



acceleration

Acceleration (a) (m/s^2): the rate of change of an object's velocity.

$$a = \frac{\Delta v}{\Delta t} \rightarrow a = \frac{v_f - v_i}{t_f - t_i}$$

v_f : the final velocity
 v_i : the initial velocity

Acceleration is equal to the **slope** in the **velocity–time** graph

- If the velocity and acceleration are in the **same direction** (both positive or both negative), **the object is accelerating**.
- If the velocity and acceleration are **opposite in direction** (one positive and the other negative), **the object is decelerating**.

An athlete runs east of the starting line (the origin). She runs at a velocity of 3 m/s, then speeds up to a velocity of 5 m/s in the opposite direction. What is her average acceleration if the time interval is 20 s?

A swimmer swims 2.5 m/s in an Olympic swimming pool. She pushes off the side of the pool and swims at 2.5 m/s in the opposite direction. What is her acceleration during this 20.0 s time interval?

A race horse coming out of the gate accelerates from rest to a velocity of 15.0 m/s due west in 1.80 s. What is its average acceleration?

acceleration

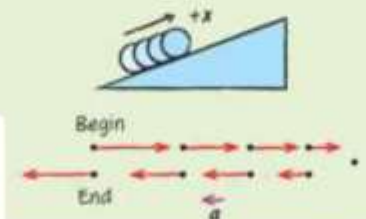
ahmad was running toward the football field with the speed of $v_i = 4.50 \text{ m/s}$. He felt he had time so he started to slow down, and he reached the speed of $v_f = 0.95 \text{ m/s}$ after 10 seconds.

What is the magnitude of his average acceleration during this 10 s time interval?

- ☐ 35.5 m/s^2
- ☐ 0.712 m/s^2
- ☐ 0.355 m/s^2
- ☐ 1.8 m/s^2

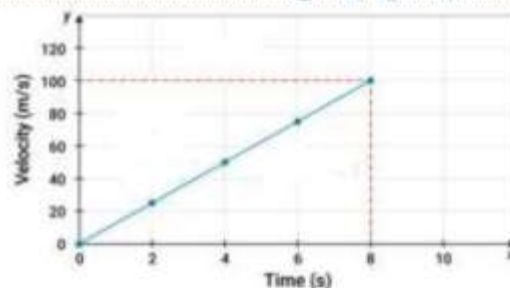
EXAMPLE Problem 2

ACCELERATION Describe a ball's motion as it rolls up a slanted driveway. It starts at 2.50 m/s, slows down for 5.00 s, stops for an instant, and then rolls back down. The positive direction is chosen to be up the driveway. The origin is where the motion begins. What are the sign and the magnitude of the ball's acceleration as it rolls up the driveway?



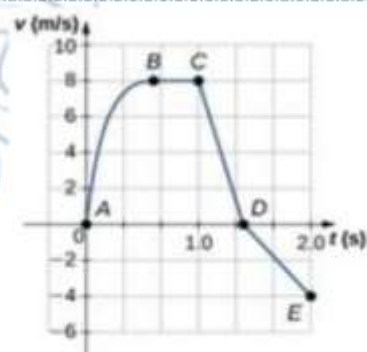
Acceleration is equal to the **slope** in the **velocity –time** graph

What is the average acceleration during the whole 8 seconds time interval ?



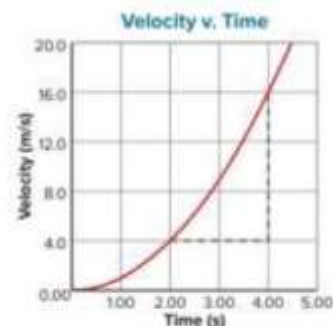
Which of the following is correct about interval DE?

- ☐ $a = 0 \text{ m/s}^2$
- ☐ $a = -2 \text{ m/s}^2$
- ☐ $a = -4 \text{ m/s}^2$
- ☐ $v = 0 \text{ m/s}$



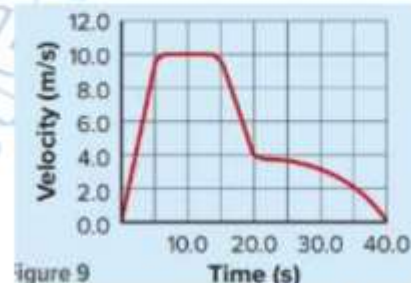
acceleration

What is the average acceleration in the time interval from 2 to 4 seconds ?



3. Refer to **Figure 9** to find the average acceleration of the train during the following time intervals.

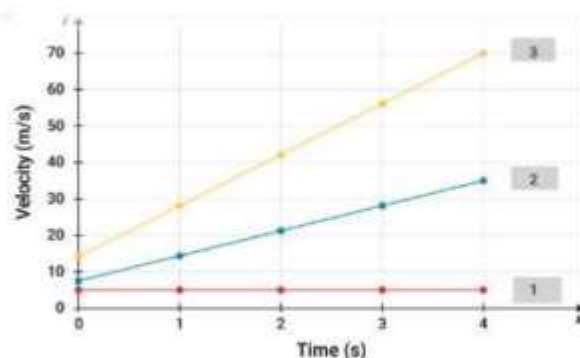
- a. 0.0 s to 5.0 s b. 15.0 s to 20.0 s c. 0.0 s to 40.0 s



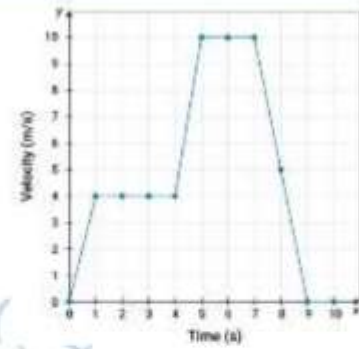
2. Use the v-t graph of the toy train in **Figure 9** to answer these questions.

- When is the train's speed constant?
- During which time interval is the train's acceleration positive?
- When is the train's acceleration most negative?

which car has the highest acceleration ?

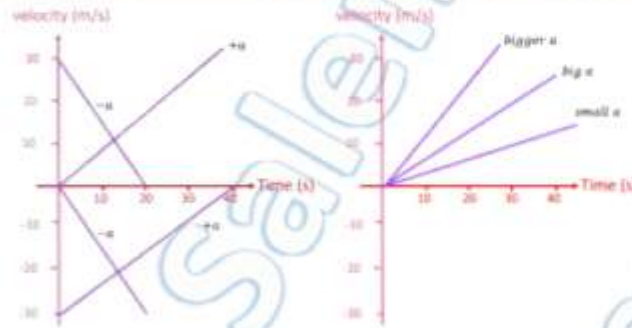


An athlete runs along a track. What is the average acceleration of the athlete between 7 and 9 seconds?



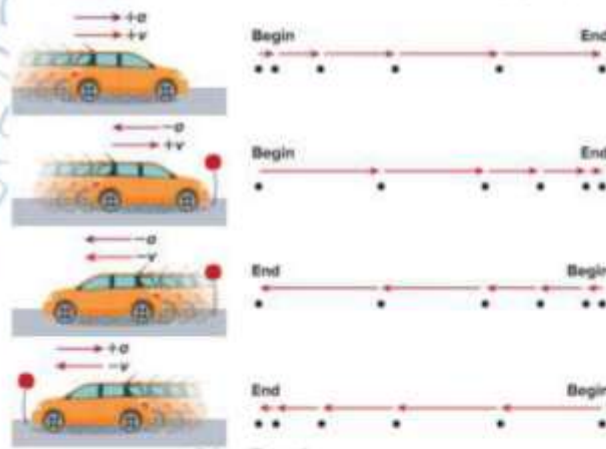
We found out that in a velocity time graph :

- an incline means positive acceleration
- A decline means negative acceleration
- The steeper the line, the greater the acceleration.



Direction of acceleration

- If the velocity and acceleration are in the **same direction** (both positive or both negative), **the object is accelerating**.
- If the velocity and acceleration are **opposite in direction** (one positive and the other negative), **the object is decelerating**.



DON'T forget!: Direction of motion always same as direction of velocity

Position and Velocity time graphs for different types of motion



Instantaneous acceleration

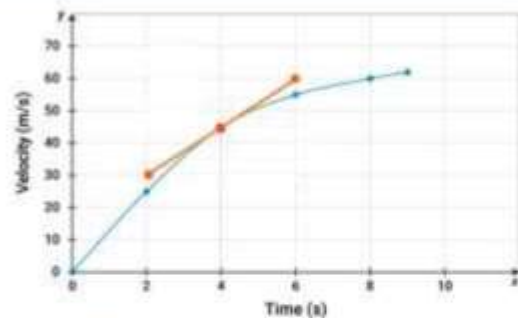
instantaneous acceleration (a) (m/s^2): is the acceleration **at a specific instant of time** on the graph. It is denoted by a .

what is the instantaneous acceleration a at $t = 4$ s?

13. draw a **tangent** to the point mentioned on the curve.

14. calculate the slope of the tangent.

15. The slope of the tangent is the instantaneous acceleration



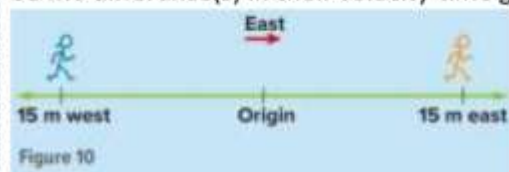
5. A race car's forward velocity increases from 4.0 m/s to 36 m/s over a 4.0-s time interval. What is its average acceleration?

6. The race car in the previous problem slows from 36 m/s to 15 m/s over 3.0 s. What is its average acceleration?

7. A bus is moving west at 25 m/s when the driver steps on the brakes and brings the bus to a stop in 3.0 s. a. What is the average acceleration of the bus while braking? b. If the bus took twice as long to stop, how would the acceleration compare with what you found in part a?

8. A car is coasting backward downhill at a speed of 3.0 m/s when the driver gets the engine started. After 2.5 s, the car is moving uphill at 4.5 m/s. If uphill is chosen as the positive direction, what is the car's average acceleration?

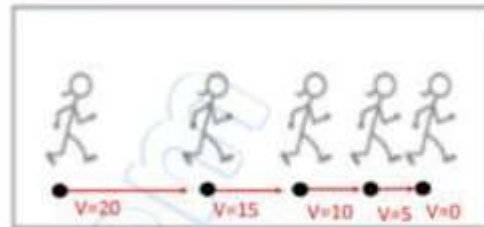
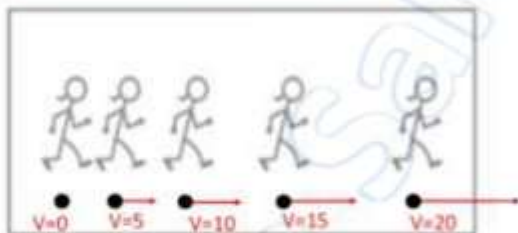
12. Two joggers run at a constant velocity of 7.5 m/s east. Figure 10 shows the positions of both joggers at time $t = 0$. a. What would be the difference(s) in the position-time graphs of their motion? b. What would be the difference(s) in their velocity-time graphs?



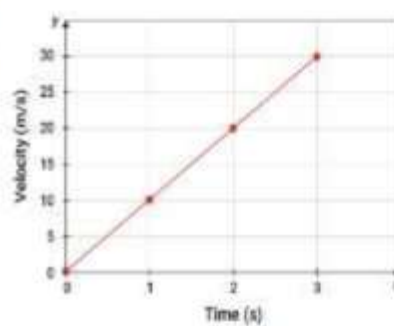
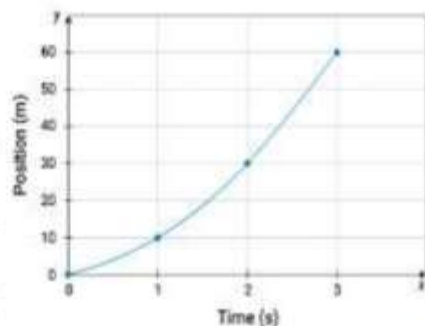
Section 3.2 motion with constant acceleration

Constant acceleration

- The velocity increases by 5 m/s every second
- This increase is constant (الزيادة ثابتة)
- The acceleration is constant
- The velocity decreases by 5 m/s every second
- This decrease is constant (النقصان ثابت)
- The acceleration is constant



- Motion with constant acceleration:** a type of motion where the object experiences a **constant increase or decrease** in its velocity
- For an object moving with a constant acceleration to the right, the position time graph looks like a curve, while the velocity time graph is an incline



Area



$$\text{area} = \frac{1}{2} \times \text{base} \times \text{height}$$



$$\text{area} = \text{length} \times \text{width}$$



$$\text{area} = h \times \frac{a+b}{2}$$

Displacement from a velocity time graph

To find the displacement from a velocity time graph, we find the **area under the curve**

Example :

What is the displacement of the object during the first 20 s of its motion?



Displacement from a velocity time graph

20. The graph describes the motion of two bicyclists, Akiko and Brian, who start from rest and travel north, increasing their speed with a constant acceleration. What was the total displacement of each bicyclist during the time shown for each?

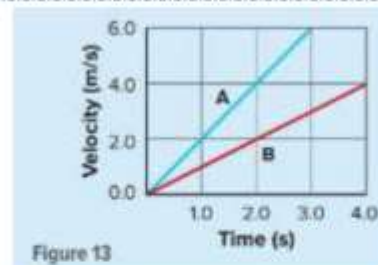
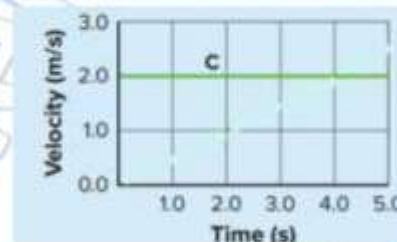
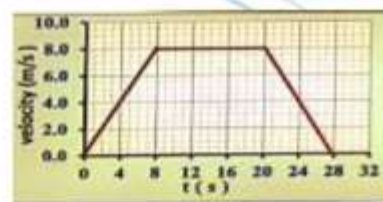


Figure 13

21. The motion of Carlos is described by the velocity time graph. What is the total displacement during the first 4.0 s interval?



24. Calculate the total displacement of Rashid from (0s) to (28 s).



Motion with constant acceleration equations

$$\Delta x = x_f - x_i$$

When the acceleration is constant, 3 equations can be used to solve for different unknowns

$$V_f = V_i + a\Delta t$$

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

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

quantity	اسم الكمية	الرمز	وحدة القياس Unit
Final velocity	السرعة النهائية	V_f	m/s , km/h
Initial velocity	السرعة الابتدائية	V_i	m/s , km/h
acceleration	التسارع	a	m/s ²
Time interval	الفترة الزمنية	Δt	s , min
displacement	الازاحة	Δx	cm , m , km
Initial position	الموقع الابتدائي	x_i	cm , m , km
Final position	الموقع النهائي	x_f	cm , m , km

To solve problems :

- Write the knowns and unknowns in symbols, sketch the problem.
- Make sure the units are unified. (one unit for distance and one unit for time)
- Choose the suitable equation
 - The equation must have the unknown
 - The other quantities in the equation must be known.
- Substitute and solve for the unknown.

Motion with constant acceleration equations

example : if you have this list of knowns , which equation will you use to find the unknown?

Knowns:

$$V_i = 0 \text{ m/s}$$

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

$$\Delta t = 10 \text{ s}$$

Unknown:

$$V_f = ?$$

$$V_f = V_i + a\Delta t$$

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

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

Knowns:

$$V_i = 0 \text{ m/s}$$

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

$$\Delta x = 12 \text{ m}$$

Unknown:

$$V_f = ?$$

$$V_f = V_i + a\Delta t$$

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

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

Knowns:

$$V_i = -1 \text{ m/s}$$

$$\Delta t = 5.5 \text{ s}$$

$$a = -2 \text{ m/s}^2$$

Unknown:

$$\Delta x = ?$$

$$V_f = V_i + a\Delta t$$

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

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

Knowns:

$$V_i = -1 \text{ m/s}$$

$$V_f = 7 \text{ m/s}$$

$$a = 0.5 \text{ m/s}^2$$

Unknown:

$$\Delta x = ?$$

$$V_f = V_i + a\Delta t$$

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

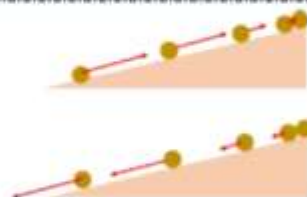
$$\Delta x = V_i\Delta t + \frac{1}{2}a\Delta t^2$$

16. A golf ball rolls up a hill toward a miniature-golf hole. Assume the direction toward the hole is positive.

- a. If the golf ball starts with a speed of 2.0 m/s and slows at a constant rate of 0.50 m/s^2 , what is its velocity after 2.0 s ?

Knowns:

Unknown:



Motion with constant acceleration equations

- b. What is the golf ball's velocity if the constant acceleration continues for 6.0 s?

Knowns:

Unknown:

17. A bus traveling 30.0 km/h east has a constant increase in speed of 1.5 m/s^2 . What is its velocity 6.8 s later?



Knowns:

Unknown:

18. If a car accelerates from rest at a constant rate of 5.5 m/s^2 north, how long will it take for the car to reach a velocity of 28 m/s north?



Knowns:

Unknown:

19. A car slows from 22 m/s to 3.0 m/s at a constant rate of 2.1 m/s^2 . How many seconds are required before the car is traveling at a forward velocity of 3.0 m/s?



Knowns:

Unknown:

EXAMPLE Problem 4

DISPLACEMENT An automobile starts at rest and accelerates at 3.5 m/s^2 after a traffic light turns green. How far will it have gone when it is traveling at 25 m/s?



Section 3: Free Fall

Main Idea

The acceleration of an object in **free fall** is due to **gravity alone**.

K What I Know	W What I Want to Find Out	L What I Learned

Essential Questions

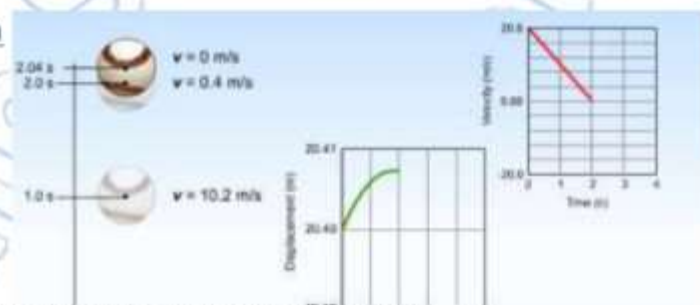
- What is **free-fall acceleration**?

How do objects in **free fall** move?

Galileo's Discovery and Free-Fall Acceleration

Go to your ConnectedED resources to play

Animation: Acceleration Due to Gravity.



Free-Fall Acceleration

- Free fall** is the motion of an object when gravity is the only significant force acting on it.
- The acceleration of an object due only to the effect of gravity is known as **free-fall acceleration**.
- Free-fall acceleration is represented by the symbol g . Near Earth's surface, $g = 9.80 \text{ m/s}^2$ downward.



Complete the following statements about free-fall acceleration.

- Free fall is the motion of an object when **gravity is the only significant force acting on it**.
- Galileo discovered that, neglecting the effect of air, all objects in free fall **have the same acceleration**.
- Galileo's results were verified **in 1971, by an experiment done on the Moon**.
- Near Earth's surface, free-fall acceleration is **about 9.8 m/s^2 downward**.

Acceleration is the rate of change in an object's velocity, and the acceleration of an object in free fall is due to gravity alone.

47. MAIN IDEA Suppose you hold a book in one hand and a flat sheet of paper in another hand. You drop them both, and they fall to the ground. Explain why the falling book is a good example of free fall, but the paper is not.

Free fall is the motion of an object when gravity is the only significant force on it. Air significantly affects the paper but not the book.

48. Final Velocity Your sister drops your house keys down to you from the second-floor window, as shown in **Figure 25**. What is the velocity of the keys when you catch them?

9.2 m/s downward

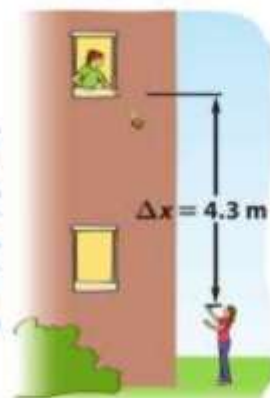


Figure 25

49. Free-Fall Ride Suppose a free-fall ride at an amusement park starts at rest and is in free fall. What is the velocity of the ride after 2.3 s? How far do people on the ride fall during the 2.3-s time period?

The people fall 26 m during the 2.3-s time period.

50. Maximum Height and Flight Time The free-fall acceleration on Mars is about one-third that on Earth. Suppose you throw a ball upward with the same velocity on Mars as on Earth.

a. How would the ball's maximum height compare to that on Earth?

The maximum height would be three times higher on Mars.

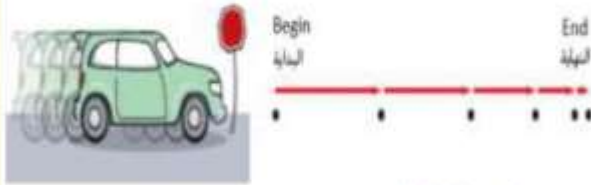
b. How would its flight time compare?

Flight time is three times longer on Mars.

52. Critical Thinking A ball thrown vertically upward continues upward until it reaches a certain position, and then falls downward. The ball's velocity is instantaneously zero at that highest point. Is the ball accelerating at that point? Devise an experiment to prove or disprove your answer.

Sample Answer: The ball is accelerating; its velocity is changing. Take a multiframe photo to measure its position. From photos, calculate the ball's velocity.

تتحرك سيارة من نقطة البداية باتجاه اليمين بسرعة متغيرة وبخط مستقيم حتى تصل لنقطة النهاية، كما هو موضح في الشكل. إي العبارات التالية صحيحة بالنسبة **لحركة السيارة** ؟



تتناقص السرعة ويكون التسارع باتجاه اليمين
I decreases and acceleration is directed to the right

السرعة المتجهة والتسارع ثابتين بالمقدار باتجاه اليمين
and acceleration remain constant in magnitude and both are directed to the right

تزداد السرعة و يكون التسارع باتجاه اليسار

increases and acceleration is directed to the left

تتناقص السرعة ويكون التسارع باتجاه اليسار

يمثل الرسم البياني السرعة المتجهة مع الزمن لجسم متحرك. ما هو **التسارع المتوسط** للجسم خلال الفترة الزمنية بين $(t = 2.0 \text{ s})$ و $(t = 4.0 \text{ s})$ ؟

$(0.0) \text{ m/s}^2$

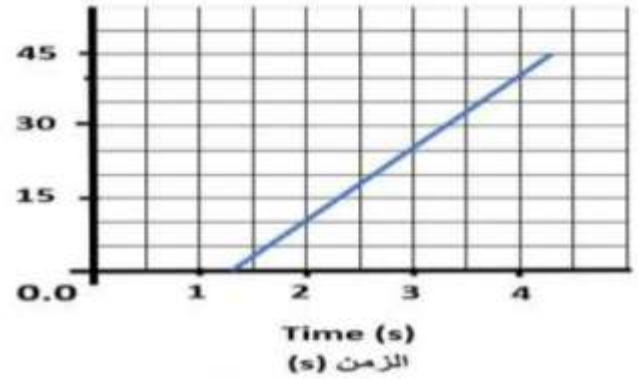
$(+ 11) \text{ m/s}^2$

$(+ 5.0) \text{ m/s}^2$

$(+ 15) \text{ m/s}^2$

السرعة المتجهة (m/s)

Velocity (m/s)



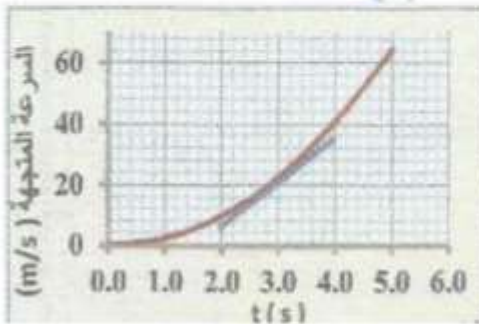
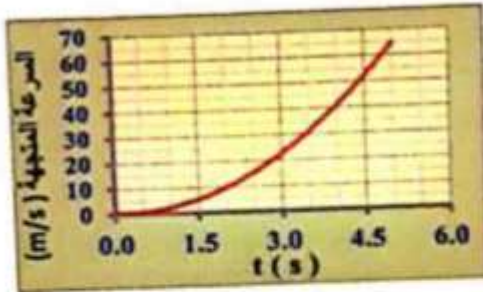
9- اعتمادا على الرسم البياني المجاور لحركة سيارة سباق ، ما **تسارع** السيارة خلال الفترة من (1.5 s) إلى (4.5 s) ؟

0.0 m/s^2 ☐

18 m/s^2 ☐

15 m/s^2 ☐

5.0 m/s^2 ☐



- ماذا يمثل ميل المماس في الرسم البياني المجاور لحركة جسم ؟

سرعة الجسم عندما $(t = 3.0 \text{ s})$

تسارع الجسم عندما $(t = 3.0 \text{ s})$

إزاحة الجسم عندما $(t = 3.0 \text{ s})$

تسارع الجسم في الفترة (من $t = 0.0 \text{ s}$ إلى $t = 5.0 \text{ s}$)

$$\frac{(v_f - v_i)^2}{2x} = \frac{v_f^2 - v_i^2}{x}$$

ما الصيغة الرياضية الصحيحة لإيجاد مقدار التسارع (a) عند استخدام المعادلة $v_f^2 = v_i^2 + 2ax$ ؟

$$\frac{v_f^2 + v_i^2}{2x} = \frac{v_f^2 - v_i^2}{2x}$$

يركض أحمد نحو ملعب كرة القدم بسرعة $(v_i = 4.50 \text{ m/s})$. عندما نظر إلى ساعته لاحظ أن لديه متسع من الوقت قبل أن تبدأ المباراة فأخذ يبطئ من سرعته خلال فترة زمنية مقدارها 10.0 s ، لتصبح سرعته النهائية $(v_f = 0.95 \text{ m/s})$. ما مقدار التسارع المتوسط خلال هذه الفترة التي تبلغ (10.0 s) ؟

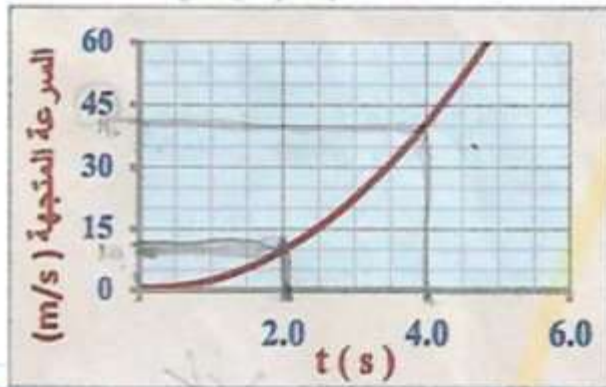
$$1.80 \text{ m/s}^2$$

$$0.712 \text{ m/s}^2$$

$$0.355 \text{ m/s}^2$$

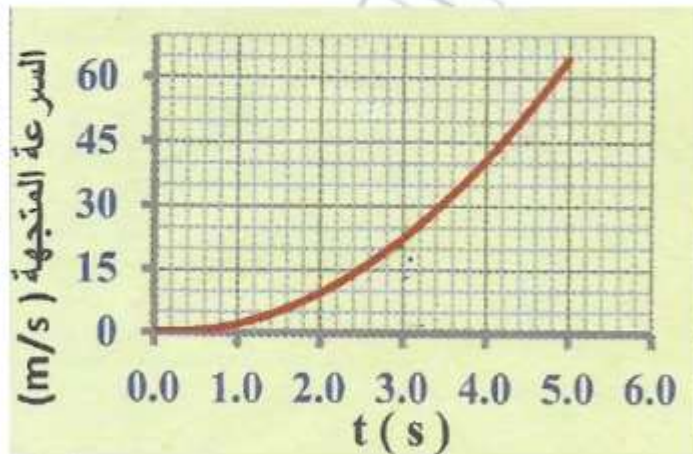
$$35.5 \text{ m/s}^2$$

9- اعتمادا على الرسم البياني المجاور لحركة سيارة سباق ، ما تسارع السيارة خلال الفترة من (2.0 s) إلى (4.0 s) ؟



$$0.0 \text{ m/s}^2 + 11 \text{ m/s}^2 + 15 \text{ m/s}^2 + 5.0 \text{ m/s}^2$$

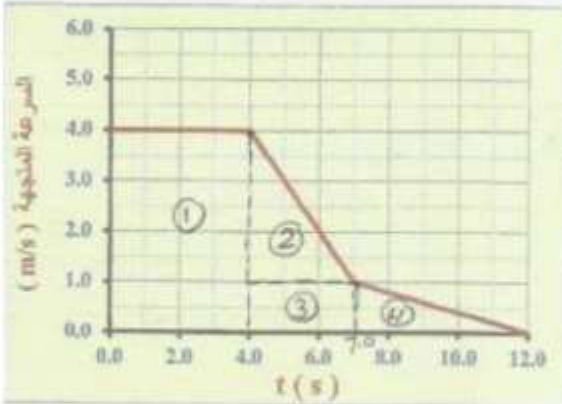
9 - اعتمادا على الرسم البياني المجاور لحركة سيارة سباق ، ما مقدار التسارع اللحظي للسيارة عندما $(t = 3.0 \text{ s})$ ؟



$$8.0 \text{ m/s}^2 \quad 15 \text{ m/s}^2$$

$$0.0 \text{ m/s}^2 \quad 5.0 \text{ m/s}^2$$

يظهر الرسم البياني المجاور تغيرات السرعة المتجهة و الزمن لحركة أحمد على دراجة هوائية حيث بدأ أحمد حركته باتجاه الشرق.



- ما الفترة الزمنية التي تحرك فيها أحمد بسرعة ثابتة ؟

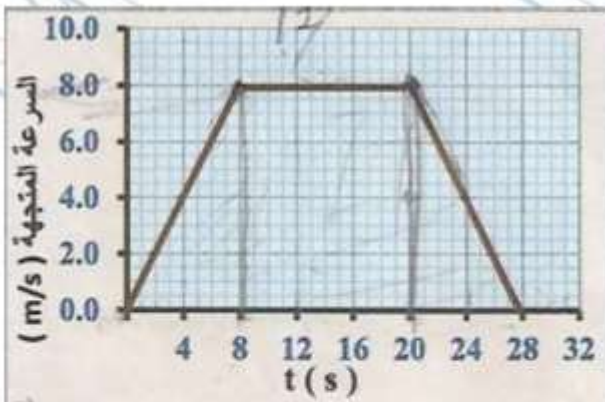
- ما اتجاه حركة أحمد خلال الفترة (4.0 s إلى 7.0 s) ؟

15- أوجد إزاحة أحمد خلال الـ (12.0 s).

14- احسب تسارع حركة أحمد في الفترة (من 4.0 s إلى 7.0 s).

يظهر الرسم البياني المجاور تغيرات السرعة المتجهة و الزمن لحركة راشد على دراجة هوائية حيث بدأ راشد حركته باتجاه الشمال . (أجب عن الفقرات 22 و 23 و 24)

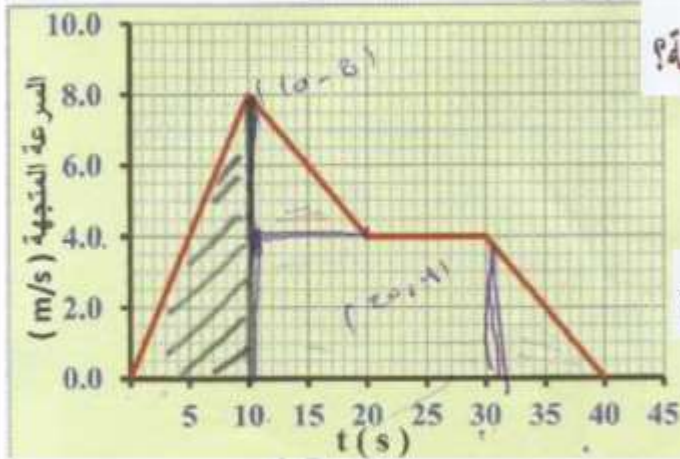
22- ما الفترات الزمنية التي تحرك فيها راشد بسرعة ثابتة؟



23- احسب تسارع حركة راشد خلال الفترة من (20 s) إلى (24 s).

24- احسب مقدار إزاحة راشد خلال الفترة من (0 s) إلى (28 s).

- 1- يظهر الرسم البياني المجاور تغيرات السرعة المتجهة و الزمن لحركة راشد على دراجة هوائية حيث بدأ راشد حركته باتجاه الشرق .
- أجب عن الآتية :



- ما الفترات الزمنية التي تحرك فيها راشد بسرعة متجهة ثابتة؟

- ما اتجاه حركة راشد خلال الفترة (30 s إلى 40 s) ؟

27- احسب تسارع حركة راشد خلال الفترة (من 10 s إلى 20 s) .

28- أوجد إزاحة راشد بعد (10 s) من بدء حركته .

سقط أصيص زهور من شرفة مرتفعة عن الأرض واستغرق سقوطه زمناً مقداره (3.5 s) قبل أن يرتطم بالأرض. ما هو ارتفاع الشرفة عن سطح الأرض ؟
أهمل مقاومة الهواء.

16 m

85 m

8.5 m

60 m

12- سقطت سلسلة مفاتيح من حافة نافذة بناية في مدينة دبي فوصلت سطح الأرض بعد (3.0 s)، بإهمال مقاومة الهواء، ما ارتفاع حافة النافذة عن سطح الأرض؟

88 m

44 m

29 m

15 m

10- سقطت كرة من السكون عن حافة نافذة بناية في مدينة أبوظبي فوصلت سطح الأرض بعد (4.0 s)، بإهمال مقاومة الهواء، ما إزاحة الكرة بعد (2.1 s) من سقوطها؟

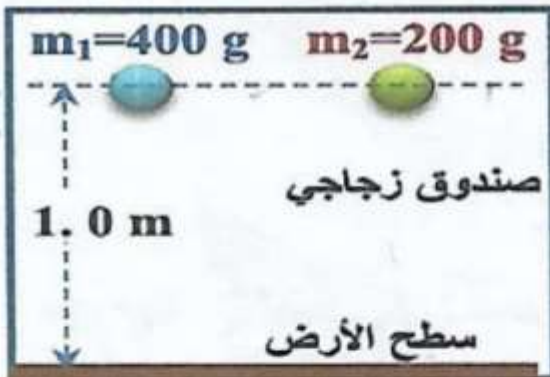
-11 m

-78 m

-39

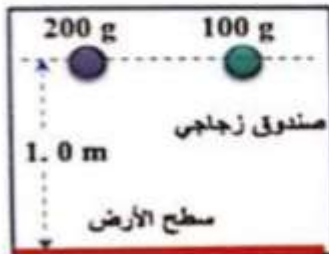
-22 m

12- في الشكل المجاور صندوق زجاجي مفرغ من الهواء موضوع على سطح الأرض و بداخله كرتان، إذا بدأت الكرتان السقوط معا (في اللحظة نفسها)، أي الآتية صحيح لتسارع حركة الكرتين؟



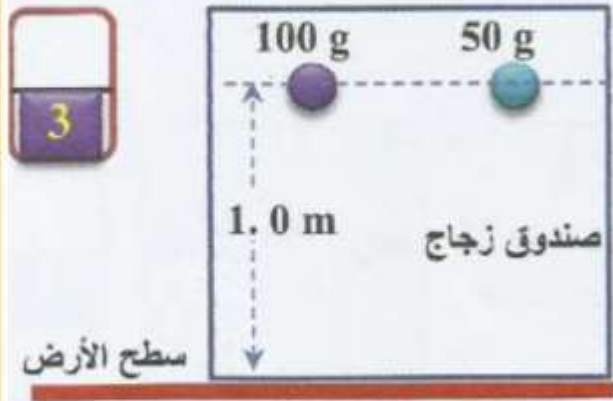
- تسارع الكرة m_1 أكبر من تسارع الكرة m_2
 تسارع الكرة m_1 أقل من تسارع الكرة m_2
 تسارع الكرة m_1 يساوي تسارع الكرة m_2
 تسارع الكرة m_1 يساوي نصف تسارع الكرة m_2

12- في الشكل المجاور صندوق زجاجي مفرغ من الهواء موضوع على سطح الأرض و بداخله كرتان، إذا بدأت الكرتان السقوط معا (في اللحظة نفسها)، أي الآتية صحيح لحركة الكرتين؟



- ☐ تصل الكرة (100 g) سطح الأرض أولا
☐ تصل الكرة (200 g) سطح الأرض أولا
☐ تصل الكرتان سطح الأرض معا
☐ لن تصل أي من الكرتين سطح الأرض

- صندوق زجاجي مفرغ من الهواء موضوع على سطح الأرض و بداخله كرتان
كما في الشكل المجاور، اذا بدأت الكرتان السقوط معا (في اللحظة نفسها).
- 2 - أي الكرتين **تصل قاع الصندوق أولا ؟ ولماذا ؟**



- 10- سقط مفتاح من حافة نافذة بناية في مدينة دبي فوصل سطح الأرض بعد (2.5 s)، بإهمال مقاومة الهواء،
ما ارتفاع حافة النافذة عن سطح الأرض؟

31 m ☐
61 m ☐

16 m ☐
25 m ☐

- سقطت سلسلة مفاتيح من الحافة السفلية لنافذة بناية في مدينة دبي سقوطا حرا فوصلت سطح الأرض
بعد (2.0 s). t

- 16- احسب ارتفاع حافة النافذة عن سطح الأرض

- 17- احسب سرعة السلسلة عندما كانت على ارتفاع (13.6 m) من سطح الأرض