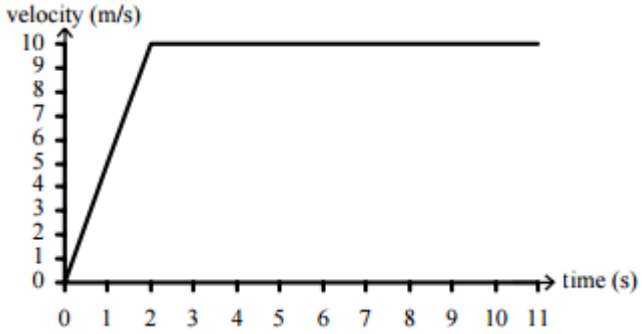
Year. 10 PHYSICS

Forces and Motion

1. The graph below is an idealised velocity-time graph for a sprinter.

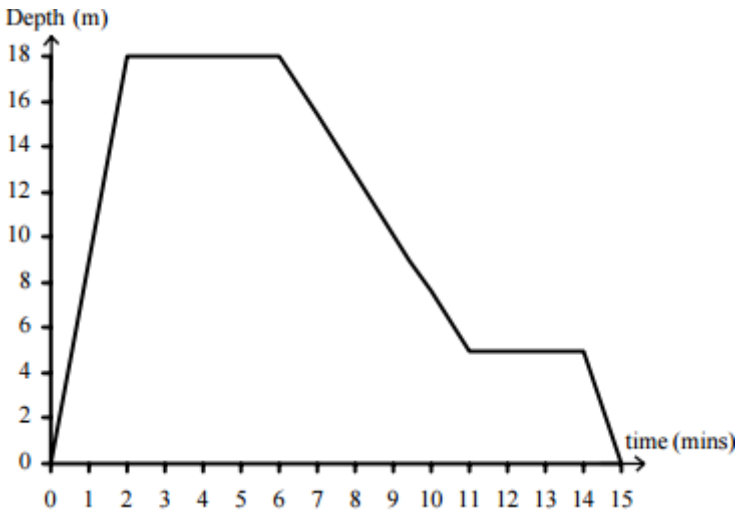


(a) What is the initial acceleration of the sprinter?

(b) Over what distance did the sprinter race?

2. The graph below represents the depth of a scuba diver during a 15 minute dive.

(a) Describe the motion of the scuba diver during the 15 mins dive.



(b) During which period of the dive was the diver the quickest?

(c) How long did the diver stay at the bottom of the sea, a depth of 18m?

(d) What was the velocity of the diver during his descent?

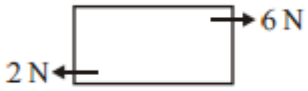
3. A supertanker of mass 4.0×10^8 kg, cruising at an initial speed of 4.5 m s^{-1} , takes one hour to come to rest.

(a) Assuming that the force slowing the tanker down is constant, calculate

(i) the deceleration of the tanker,

(ii) the distance travelled by the tanker while slowing to a stop.

4. Determine the resultant force on the object shown



What can be deduced about the motion of an object

(i) when the resultant force on it is zero,

(ii) when the resultant force on it is vertically upwards,

(iii) when the resultant force on it is in the opposite direction to its motion?

5. The table of results below were taken for a cyclist travelling along a straight road.

Velocity (ms^{-1})	0	5	10	15	15	12	9	6	3	0
Time taken (s)	0	10	20	30	40	50	60	70	80	90

a) Draw a graph of velocity on the vertical axis against time on the horizontal axis for the journey.

(b) Calculate the deceleration of the cyclist in the final 50 seconds of the journey.

(c) Calculate the total distance that the cyclist travelled along the straight road.

(d) Calculate the average velocity of the cyclist for the entire journey.

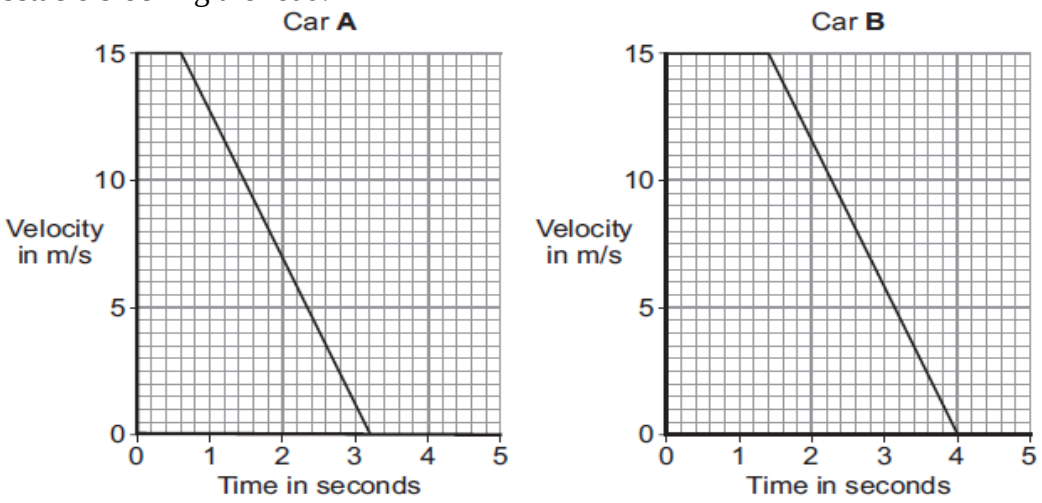
6. The manufacturer of a family car gave the following information.

Mass of car 950 kg. The car will accelerate from 0 to 33 m/s in 11 seconds.

(a) Calculate the acceleration of the car during the 11 seconds

(b) Calculate the force needed to produce this acceleration.

7. The graphs show how the velocity of two cars, **A** and **B**, change from the moment the car drivers see an obstacle blocking the road.



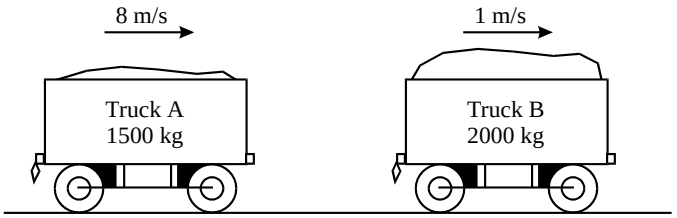
One of the car drivers has been drinking alcohol. The other driver is wide awake and alert.

(i) How does a comparison of the two graphs suggest that the driver of car **B** is the one who has been drinking alcohol?

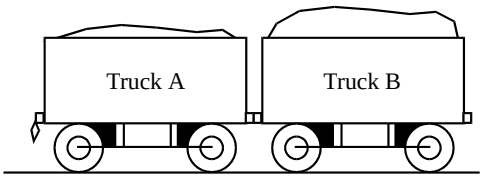
(ii) How do the graphs show that the two cars have the same deceleration?

(iii) Use the graphs to calculate how much further car **B** travels before stopping compared to car **A**.

8. The drawing below shows two railway trucks A and B, moving in the same direction. Truck **A**, of mass 1500 kg, is initially moving at a speed of 8 m/s. Truck **B**, of mass 2000 kg, is initially moving at a speed of 1 m/s.



Truck A catches up and collides with truck B. The two trucks become coupled together as shown in the diagram.



(a)Calculate:

(i) the initial momentum of truck A.

(ii) the initial momentum of truck B.

(iii) the total momentum of the trucks before the collision.

(b) Calculate the speed of the coupled trucks after the collision

9(a). If a car, starting from rest, accelerates away from a set of traffic lights for 5 seconds before reaching a steady speed of 20 m/s calculate it's acceleration.

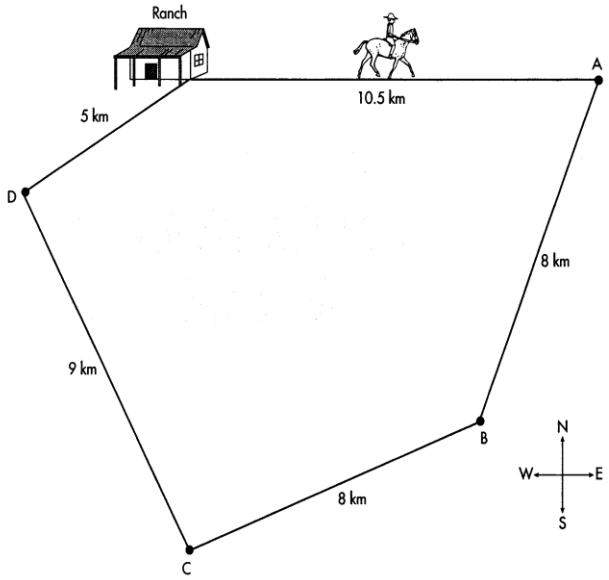
(b.) The same car, still travelling at 20 m/s then brakes to a stop at a junction in a further 4 s. Calculate this acceleration. What does the negative sign indicate?

10. Consider the boundary rider in the diagram below. He takes 3 hours to get to A, another 2 hours to get to B, 2 more to C and 3 more to D. After a total of 12 hours he is back home.

a. What is his average velocity from D to home?

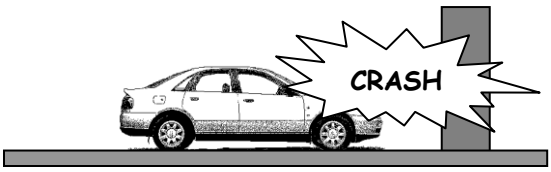
b. What is his average speed for the whole journey?

c. What is his average velocity for the whole journey?



11. A car of mass 1000 kg moving at 15 m/s hits a barrier and stops in a time of 0.1 s.

a. Calculate its deceleration.



b. What force would the car experience?

c. Today cars are built with 'crumple zones' for safety. Explain how they act to decrease the injuries to passengers.

d. With reference to Newton's Laws explain how a seat belt works.

12. Anand is riding his bicycle along a flat road. A cat crosses the road ahead of him and he uses his brakes to stop.
Give three factors, which can affect the time it takes for Anand to stop.

13. A car moves along a dry road. The driver sees danger ahead. It takes her 0.6s to react before braking. This is called her reaction time. In this time the car travels 15m.

(a) Calculate the speed of the car during the 0.6s it takes the driver to react to the danger ahead.

(b) The distance travelled before braking is the thinking distance.
The total stopping distance at this speed is 63m. What is the braking distance of the car?

(c)(i) What effect does driving on a wet road have on the driver's reaction time?

(ii) What other two factors besides speed affects the braking distance of a car?

14. A cyclist, whilst overtaking another bike, increases his speed uniformly from 4.2 m s^{-1} to 6.3 m s^{-} over a time interval of 5.3 s.

a Calculate the acceleration of the cyclist during this time.

b How far does the cyclist travel whilst overtaking?

Grade 10 topics

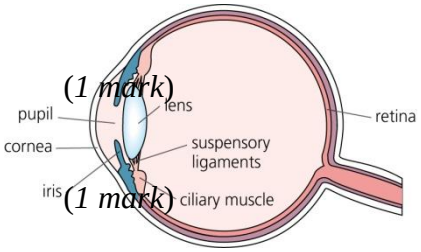
1) During a scan ultrasound of a kidney,waves are used at a frequency of 200,000 Hz.
   a. Why is this frequency considered to be ultrasound?
   b. What does 200,000 Hz actually mean?

2) An echotakes0.18ms (0.00018 s) to reflect from the kidney being scanned,if the speed of sound in the body is 1600 m s^{-1} how deep is the kidney?

3) The man measures the time between seeing a flash of lightning over the village, and hearing the first sound of thunder. The time is 4 s. The speed of sound in air is 330m/ s. How far away is the village?

4) On the moon, two astronauts cannot hear each other, even when they shout, unless they have their radios switched on.
   1. Why cannot they hear each other even when they shout?
   2. Why can they hear each other using their radios?

5) The diagram shows the basic structure of an eye.



(a) Light entering the eye is refracted by the eye lens.

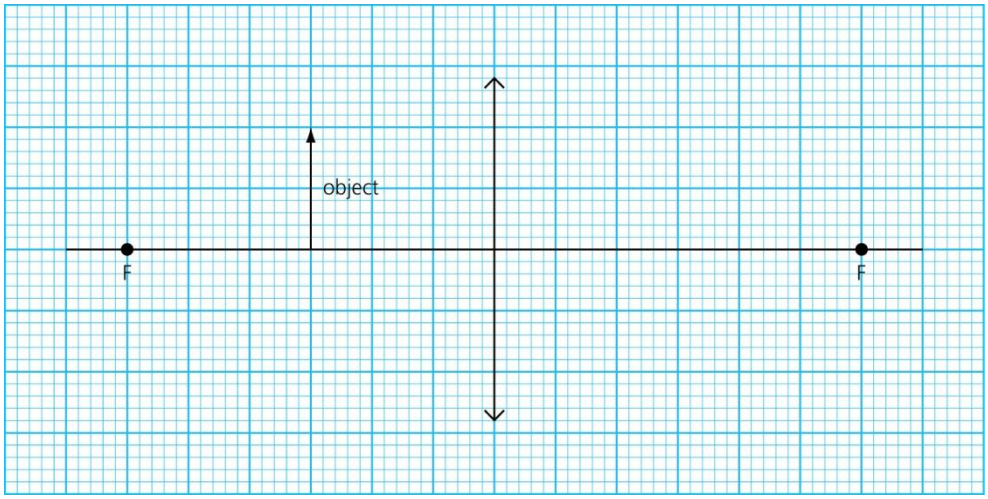
(i) What happens to light rays that are refracted? *(1 mark)*

(ii) For a person with perfect vision, where in the eye is the light refracted by the eye lens brought to a focus? *(1 mark)*

(iii) Name the other part of the eye that also refracts light?

6) (a)The diagram shows an object 3 cm in front of a converging lens of focal length 6 cm.

(i) Complete a ray diagram to show the position of the image.

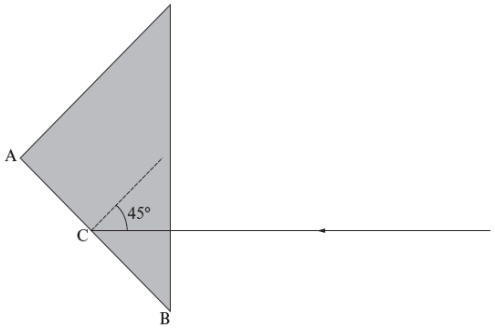


(ii) How can you tell from the completed ray diagram that the image formed is virtual.

(b) The object is now moved so that it is 8 cm from the lens.

How does the nature of the image change from when the object was 3 cm in front of the lens?

7) A reflector on the back of a bicycle is made up of many glass prisms, one of which is shown in the diagram.



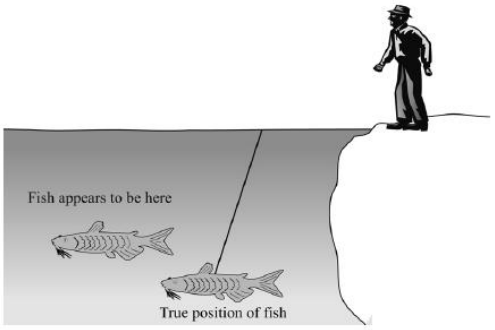
A ray of light strikes the back surface of the prism at point C at a
The critical angle for glass is 42°.

(i) Explain why the light does not leave the prism at point C.

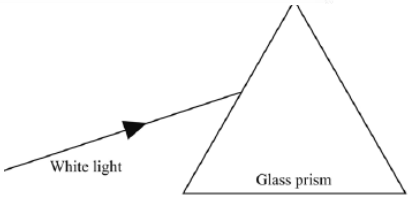
(ii) What is the name given to this effect?

8) The diagram below shows a fish in a pond. A person looking into the pond sees the fish not at its true position but at the position shown in the diagram.

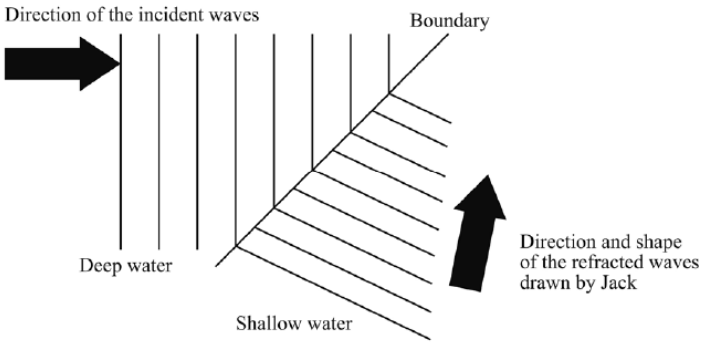
(i) Complete the diagram to show how the man sees the fish. Draw an arrow on the given ray to show its direction.



(ii)The diagram shows a ray of white light being dispersed by a triangular glass prism.
On the diagram label the **two** colours at the top and bottom of the spectrum.



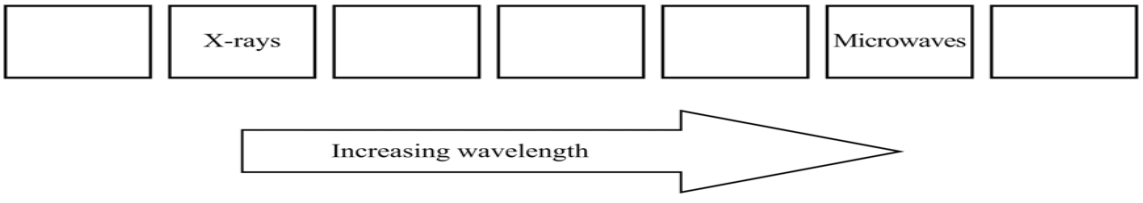
9) The diagram below shows water waves approaching the boundary between deep water and shallow water. Jack records his observations of the refracted waves.



What **two** errors have been made by Jack?

10) All waves have a wavelength and a frequency. Electromagnetic waves have changing electric and magnetic fields.Name **one other** property common to all electromagnetic waves.

(i) In the boxes below write the names of the various groups of electromagnetic waves in order of increasing wavelength (as shown by the arrow). Some have been done for you.



(ii) Which electromagnetic wave is used for the following:
making toast _____
sterilising plastic syringes _____

11)This question is about electromagnetic waves. Look at the information about three types of electromagnetic waves.

type	wavelength range in m	energy range in J
A	7×10^{-7} to 1×10^{-3}	2×10^{-22} to 3×10^{-19}
microwave	1×10^{-3} to 1×10^{-1}	3×10^{-24} to 2×10^{-22}
B	$> 1 \times 10^{-1}$	$< 3 \times 10^{-24}$

(a) Fill in the two gaps in the table labelled A and B.

(b) Microwaves are part of the electromagnetic spectrum. Microwave radiation is used in cooking and also in communications. David reads the label on the back of his microwave oven.

The speed of microwaves is 3.00×10^8 m/s.

Stainless Steel Microwave Oven
Model MMSO8
230-240V
Input power 1200W
Microwave frequency 3.44 X 10^9 Hz
Made in China

(i) Use the information on the label to calculate the wavelength of these microwaves.

12) Radio waves and microwaves are part of the electromagnetic spectrum.

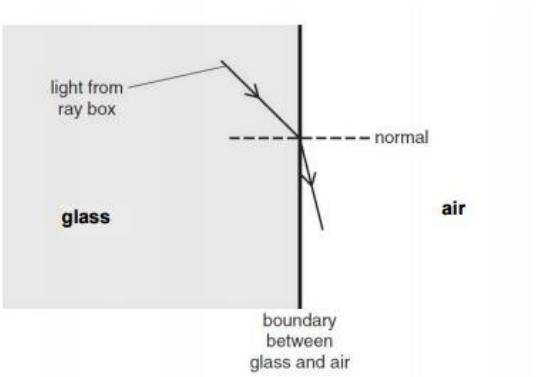
(a) Which of these statements is true for radio waves?

A radio waves have low frequency and short wavelength
B radio waves have low frequency and long wavelength
C radio waves have high frequency and short wavelength
D radio waves have high frequency and low wavelength

(b)The speed of all electromagnetic waves in a vacuum is 3.0×10^8 m/s. The wavelength of the microwaves used by mobile phones is 34 cm. Calculate the frequency of these microwaves.

13) Both infrared and ultraviolet rays can have harmful effects on our bodies. Describe how the harmful effects of these rays are different.

14) Danny shines a ray of light from a ray box through a glass block. The light is refracted. He looks at the path of the light leaving the block.



Explain what causes the ray of light to bend the way it does at the boundary.

16) Complete the diagram to show the path taken by the light ray as it travels through the optical fibre.

17) List the parts of the ear in the order in which vibrations affect them and describe the functions of each part.

18) State the difference between P waves and S waves.

19) How does the P wave and S wave shadow zones show the nature of Earth's core?

20) Describe Herschel and Ritter's contribution to the discovery of waves beyond the limits of the visible spectrum.