Lesson 3 – Dynamics and Space

(all answers are given in the online video)

1. **Scalars and vectors** – spot the vectors in the list below…

Spot the vectors…

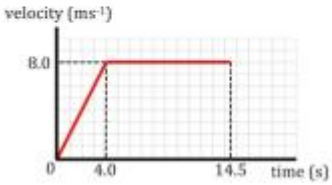
force | displacement | speed | velocity | time | mass | distance | energy | acceleration

2. First written question, on velocity-time graphs

During a school sports day, a girl takes part in a sprint race.

A graph of the girl's motion is shown from when she starts running to when she crosses the finishing line.

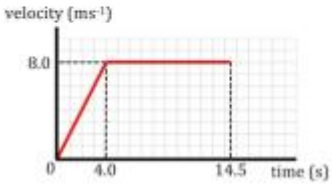
(a) Calculate the girl's acceleration during the first 4 s of the race.



During a school sports day, a girl takes part in a sprint race.

A graph of the girl's motion is shown from when she starts running to when she crosses the finishing line.

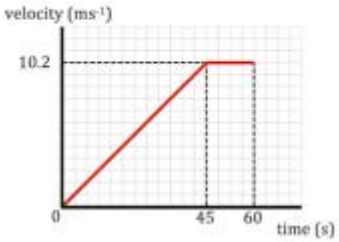
(b) Show that the distance covered by the girl was 100m



3. Another velocity-time graph, introducing Newton's laws

A man takes part in a cycling race. A graph of his motion is shown for the first minute of the race. Label the diagram, showing the horizontal forces acting on the man from 45s to 60s.

Name the forces and show their direction.



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4. **Vector addition –** look out the calculator (or ruler & protractor!)

During the first stage of an orienteering event, a woman runs 320m North in 50s then a further 460m East in 70s before reaching the first checkpoint.

(a) Calculate the woman's displacement from the starting point to the first checkpoint.

During the first stage of an orienteering event, a woman runs 320m North in 50s then a further 460m East in 70s before reaching the first checkpoint.

(b) Calculate the woman's average velocity during the first stage of the event.

5. **Rockets** – a question on Newton's 2nd law

A toy rocket of mass 143g is launched and travels upwards with an initial acceleration of $14 ms^{-2}$ for 10s.

(a) Calculate the weight of the rocket.

A toy rocket of mass 143g is launched and travels upwards with an initial acceleration of $14 ms^{-2}$ for 10s.

(b) Calculate the upward thrust on the rocket during the first 10s of launch.

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6. **The light year** (a measure of distance, not time)

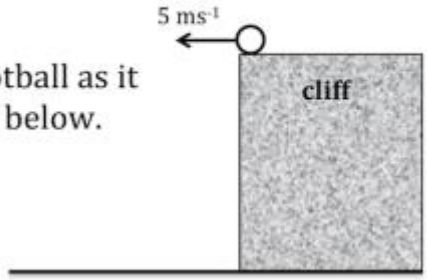
The distance from the Sun to the star 'Gliese 687' is 14.8 light years.

Calculate this distance in metres.

7. **Projectiles** – ran out of time for this one, so look out for it in the video *'Live – Dynamics and Space revisited'*

A football is kicked horizontally from a cliff at 5 ms^{-1}, as shown in the diagram below.

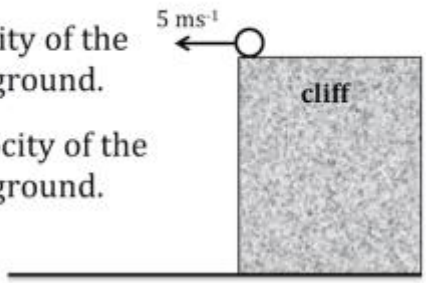
(a) Sketch the path taken by the football as it falls from the cliff to the ground below.



(b) The football takes 1.2 s to fall from the cliff to the ground.

(i) State the horizontal velocity of the football as it reaches the ground.

(ii) Calculate the vertical velocity of the football as it reaches the ground.



(c) Calculate the height of the cliff.