Barrhead High School

NATIONAL PHYSICS

Dynamics and Space

Name:

Exam Homework

Date	Homework	Mark/grade	Parent signature
	1		
	2		
	3		
	4		
	5		
	6		
	7		

The table above must be completed after each homework has been marked.

Homework tips

- Start homework as soon as possible. Do not leave it until the night before the due date.
- Refer to summary notes, jotter notes and example problems when completing homework.
- If after doing above there are any issues ask your teacher for help. This must be done at least 1 full day before due date. This will then give you the opportunity to complete the homework by due date.

Sign below to state that you have read this.

Pupil _____

Parent _____

Homework 1

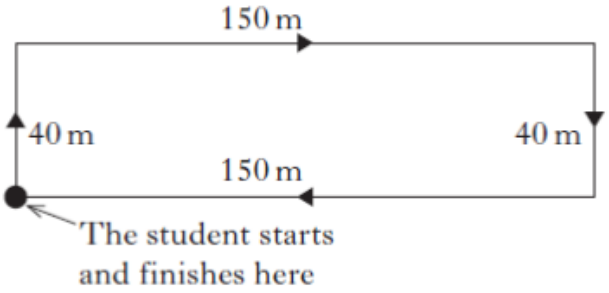
1. During training an athlete sprints 30 m East and then 40 m West.
Which row shows the distance travelled and the displacement from the starting point? 1

	Distance travelled	*Displacement*
A	10 m	10 m East
B	10 m	10 m West
C	10 m	70 m East
D	70 m	10 m West
E	70 m	10 m East

2. Which row contains two scalar quantities and one vector quantity?

A Distance, momentum, velocity
B Speed, mass, momentum
C Distance, weight, momentum
D Speed, weight, momentum
E Velocity, force, mass 1

3. A student follows the route shown in the diagram and arrives back at the starting point.

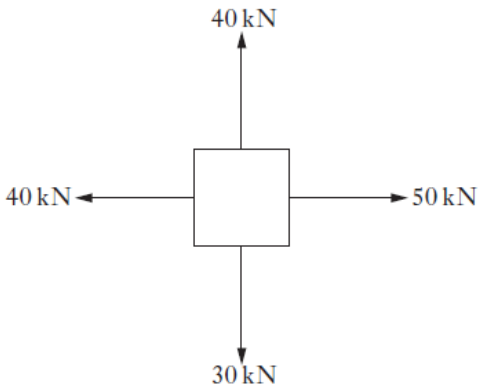


Which row in the table shows the total distance walked and the magnitude of the final displacement?

	Total distance (m)	Final displacement (m)
A	0	80
B	0	380
C	190	0
D	380	0
E	380	380

1

4. Four tugs apply forces to an oil-rig in the directions shown.



Which of the following could represent the direction of the resultant force? 1

A 

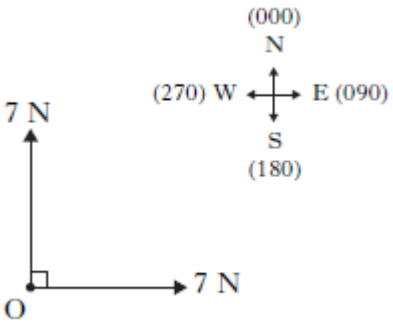
B 

C 

D 

E 

5. Two forces, each of 7N, act on an object O.
The forces act as shown.



The resultant of these two forces is

A 7 N at a bearing of 135
B 9·9 N at a bearing of 045
C 9·9 N at a bearing of 135
D 14 N at a bearing of 045
E 14 N at a bearing of 135. 1

6. Which of the following is a scalar quantity?

A Force
B Acceleration
C Momentum
D Velocity
E Energy 1

7. In the following statements X, Y and Z represent physical quantities.

X is the displacement of an object in a given time.

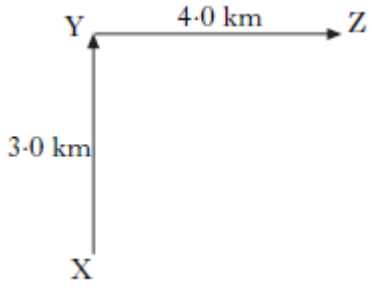
Y is the change in velocity of an object in a given time.

Z is the distance travelled by an object in a given time.

Which row in the table shows the quantities represented by X, Y and Z? 1

	X	Y	Z
A	speed	acceleration	velocity
B	velocity	speed	acceleration
C	acceleration	velocity	speed
D	acceleration	speed	velocity
E	velocity	acceleration	speed

8. A student walks from X to Y and then from Y to Z.



The complete walk takes 2 hours. Which row in the table shows the average speed and the average velocity for the complete walk? 1

	Average speed	Average velocity
A	2.5 km h^{-1}	2.5 km h^{-1} at 053
B	2.5 km h^{-1} at 053	2.5 km h^{-1}
C	3.5 km h^{-1}	2.5 km h^{-1} at 053
D	3.5 km h^{-1} at 053	3.5 km h^{-1}
E	3.5 km h^{-1}	3.5 km h^{-1} at 053

9 An aeroplane takes off from its start point and flies 100km at 180° and then 150 km at 270° and arrives at the destination. The journey takes 1.5 hours.

a) By scale drawing or otherwise determine the displacement from start to destination. **4**

b) Calculate the average speed of the aeroplane. **3**

c) Calculate the average velocity of the aeroplane. **4**

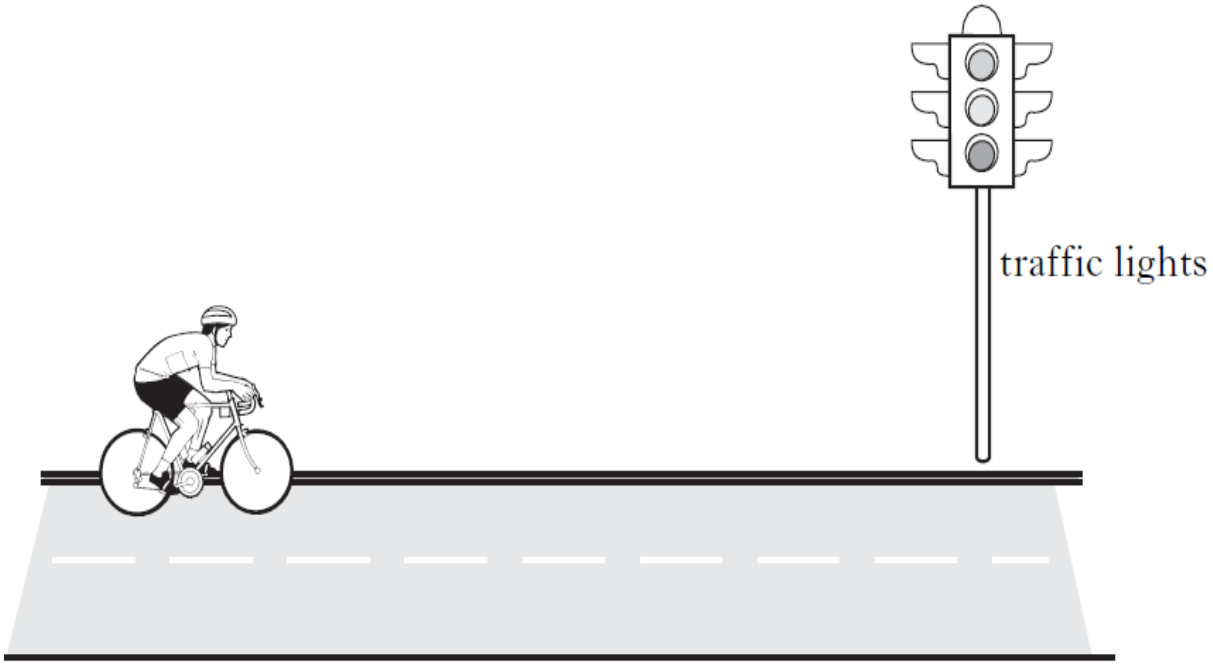
d) If the aeroplane is now to fly **directly** back to the start point from the destination, what direction would the pilot need to set? **1**

Total 20

End of homework

Homework 2

1 A cyclist rides along a road.



a) Describe a method by which the average speed of the cyclist could be measured.
Your description must include the following
• Measurements made
• Equipment used
• Any necessary calculations

3

The cyclist approaches traffic lights at a speed of 8 m/s. He sees the traffic lights turn red and 3 s later he applies the brakes. He comes to rest in a further 2.5 s.

b) i) Calculate the acceleration of the cyclist whilst braking.

3

ii) Sketch a speed time graph showing the motion of the cyclist from the moment the lights turn red until he stops at the traffic lights.
Numerical values **must** be included.

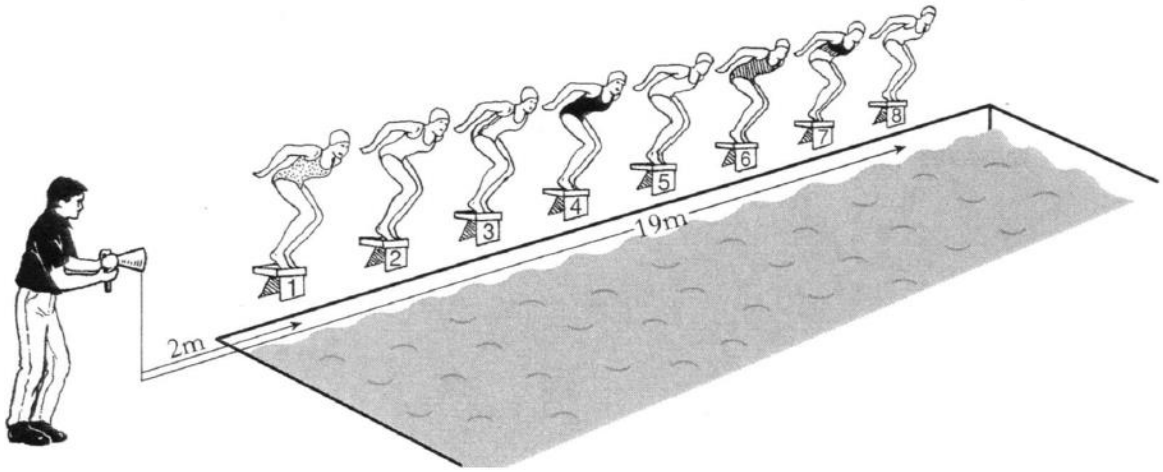
3

iii) Calculate the total distance the cyclist travels from the moment the lights turn red until he stops at the traffic lights.

3

Turn over

2 At a local swimming gala, the swimmers start when they hear the sound of the starter horn.
This horn also sends an electronic signal to start timing the race.



At the start of the race swimmer 1 is 2m from the starter and swimmer 8 is 19m from the starter.

a) Swimmer 1 hears the horn first. Calculate how much later swimmer 8 hears the horn. **4**

b) After the race the scoreboard gives the following information

Place	*Lane*	*Time* (s)
1st	1	20·52
2nd	8	20·55
3rd	5	21·91

i) Explain why swimmer 8 should be awarded 1st place **2**

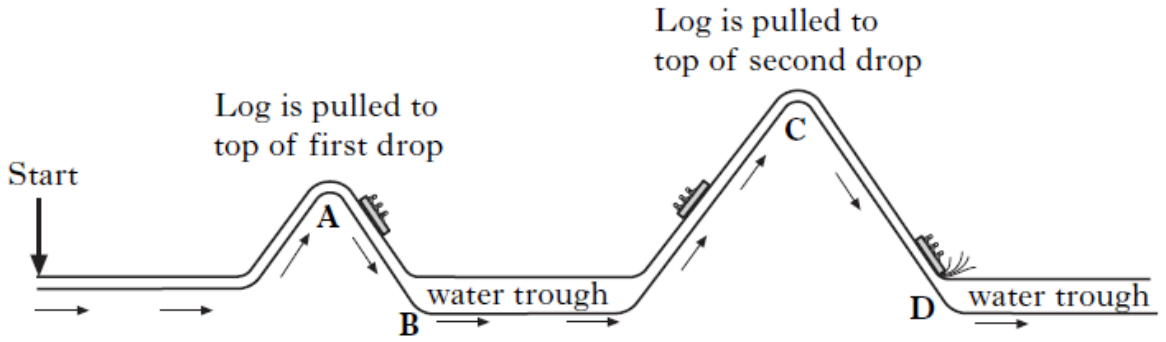
ii) Suggest an improvement to the starting system that would reduce the unfairness of the timing of the race. **1**

Total 19

End of Homework

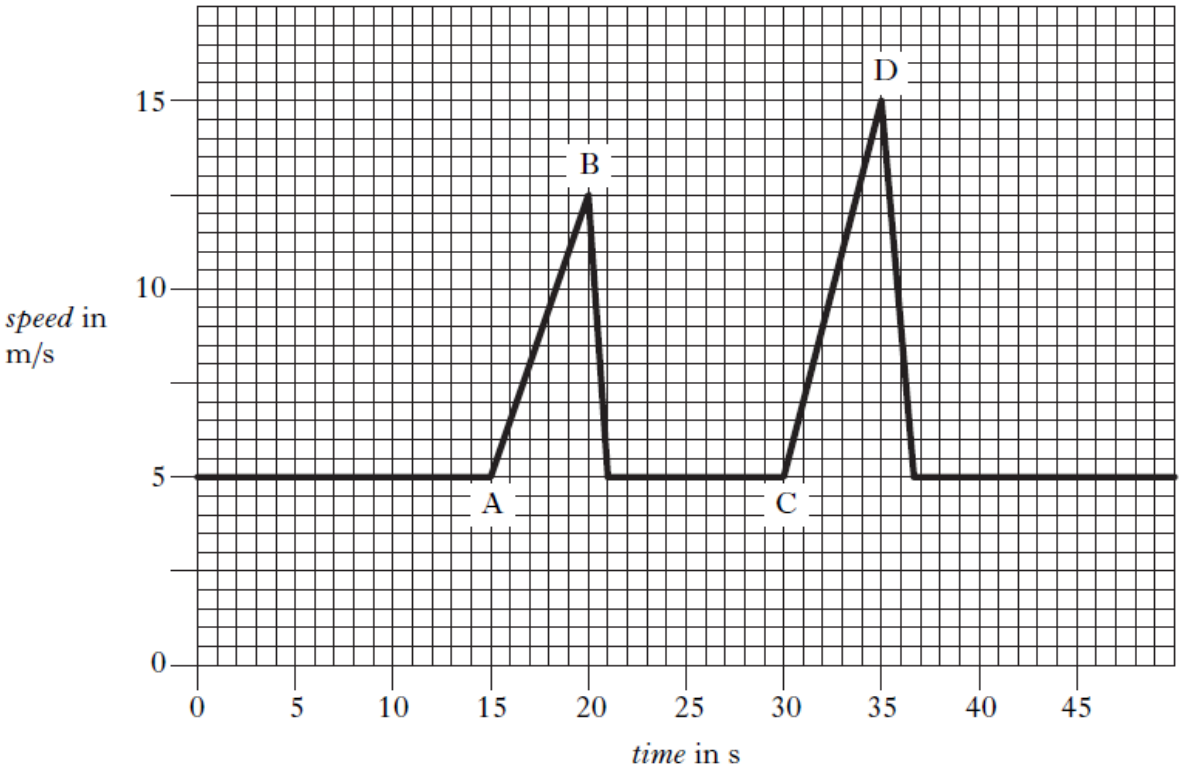
Homework 3

1 On a visit to a theme park, four students ride the log flume.



Not to scale

The graph shows how the speed of the log varies during the ride.



a) Describe the motion of the log during **AB** on the graph.

1

b) Calculate the distance travelled by the log from the start of the ride to the bottom of the first drop

3

c) Calculate the log's acceleration as it goes down the second drop.

3

Turn over

The log and the passengers have a total mass of 500 kg.

d) Calculate the unbalanced force acting on the log as it travels down the second drop. **3**

e) If the force acting down the slope acting on the log is 3500 N, calculate the force of friction acting on the log at this time. **1**

2 A plane of mass 750 kg is at rest on a runway. The engine applies a force of 4·50 kN.

a) Calculate the magnitude of the acceleration of the plane assuming there are no other forces acting on the plane at this point. **3**

b) The required velocity for take-off is 54 m s^{-1}.
Calculate the time it takes to reach this velocity assuming the acceleration is constant **3**

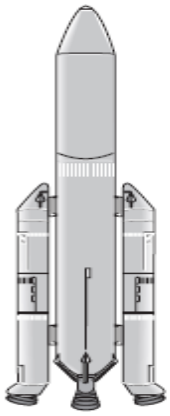
c) In practice the acceleration is not constant. Suggest a reason for this and explain your answer. **2**

Total 19

End of Homework

Homework 4

1 In 2014 the European Space Agency will fly a manned mission to the International Space Station (ISS)



A spacecraft with booster rockets attached will be launched.

a) On the diagram above draw and label the two forces acting on the spacecraft at lift off. **2**

b) The combined mass of the spacecraft and booster rockets is $3{\cdot}08 \times 10^5$ kg and the initial thrust on the rocket at lift off is 3352 kN. The frictional forces acting on the rocket at lift off are negligible.

i) Calculate the weight of the spacecraft and booster rockets at lift off. **3**

ii) Calculate the acceleration of the spacecraft and booster rockets at lift off. **3**

c) An astronaut on board the ISS takes part in a video link-up with a group of students. The students see the astronaut floating.

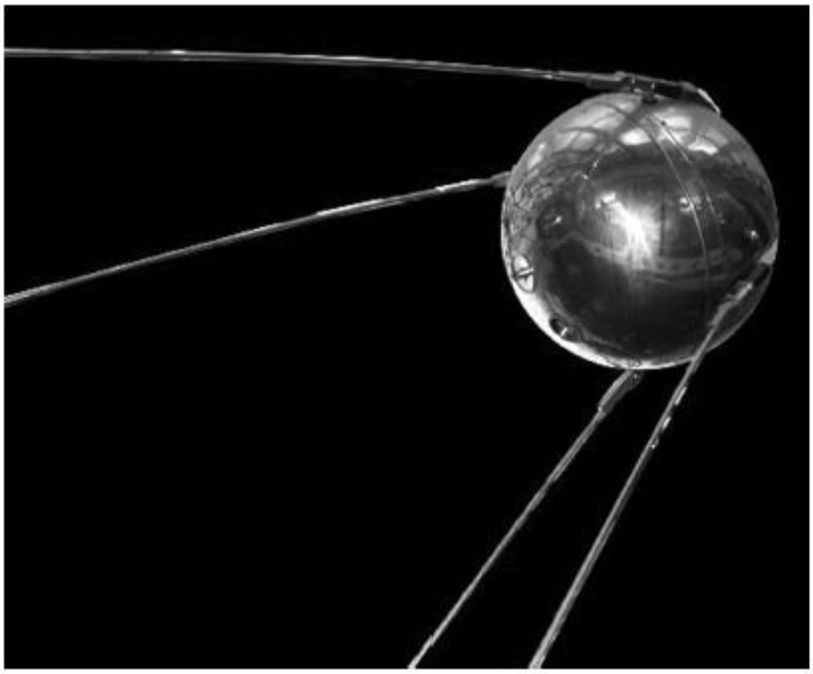
i) Explain why the astronaut appears to float. **1**

ii) The astronaut then pushes against a wall and moves off.
Explain in terms of Newton's Third Law why the astronaut moves. **1**

d) Explain how the ISS remains in orbit around the Earth **2**

Turn over

2 Sputnik 1, the first man-made satellite, was launched in 1957. It orbited the Earth at a speed of 8300 m s^{-1} and had a mass of 84 kg.



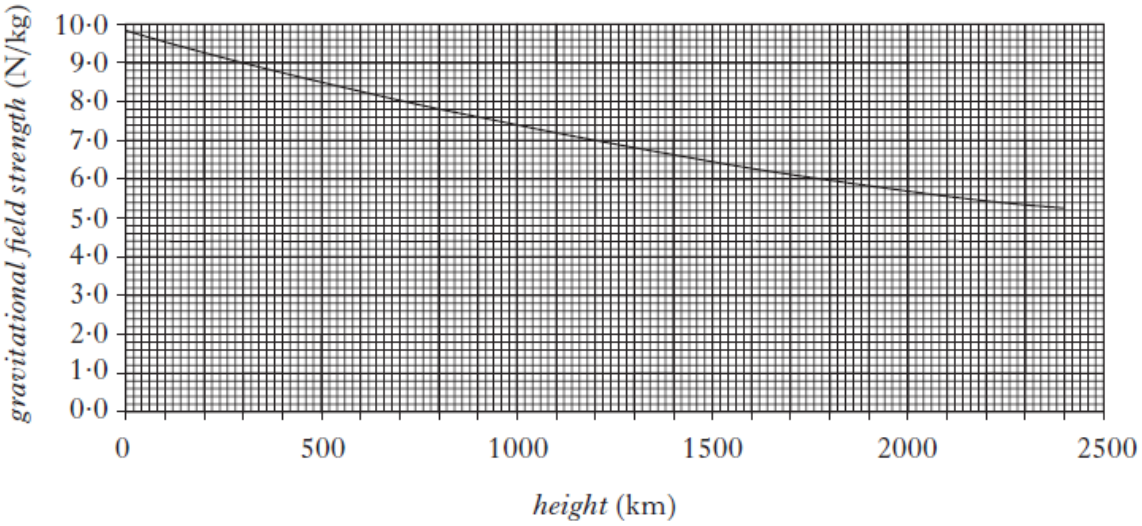
a) Although Sputnik 1 travelled at a constant speed in a circular orbit, it accelerated continuously.
Explain this statement.

2

b) Sputnik 1 transmitted radio signals a distance of 800 km to the surface of the Earth.
Calculate the time taken for the signals to reach the Earth's surface.

3

c) The graph shows how gravitational field strength varies with height above the surface of the Earth.



i) State the value of the gravitational field strength at a height of 800 km.

1

ii) Calculate the weight of Sputnik 1 at this height.

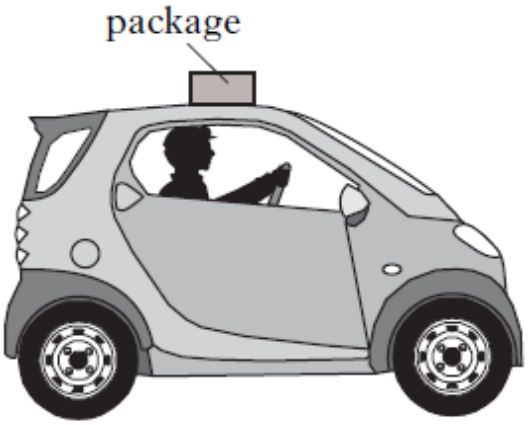
3

Total 21

End of Homework

Homework 5

1 A car driver exits a car park having accidentally left a package resting on the roof of the car. The car is travelling at a constant velocity of 15 m s^{-1} when the driver brakes suddenly and the car stops. The package continues to move forward.



a) i) On the above diagram sketch the path taken by the package.

1

ii) Explain why the package follows this path

2

b) The package takes 0.55 s to fall to the ground.
Calculate its vertical velocity as it reaches the ground.

3

c) Calculate the horizontal distance travelled by the package after the car comes to a halt.

3

d) How would the horizontal distance travelled by the package after the car stops compare if the driver was driving a taller car in the same situation and at the same velocity.

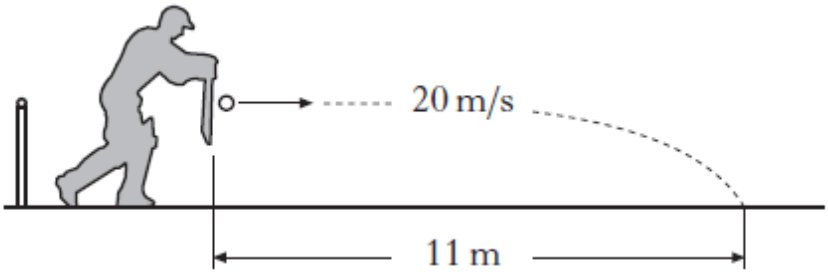
2

e) If a package of greater mass is left on the roof of the car, will it travel a greater, smaller or the same horizontal distance than the smaller mass package.
Explain your answer.

2

Turn over

2 A cricketer strikes a ball. The ball leaves the bat horizontally at 20 m s^{-1}.
It hits the ground at a horizontal displacement of 11 m from the point where it was struck.



a) Calculate the time of flight of the ball.

3

b) Calculate the vertical velocity of the ball as it reaches the ground.

3

c) Sketch a graph of vertical velocity against time for the ball.
Numerical values are required on both axes.

2

d) How high above the ground did the cricket bat make contact with the ball?
Show your calculation.

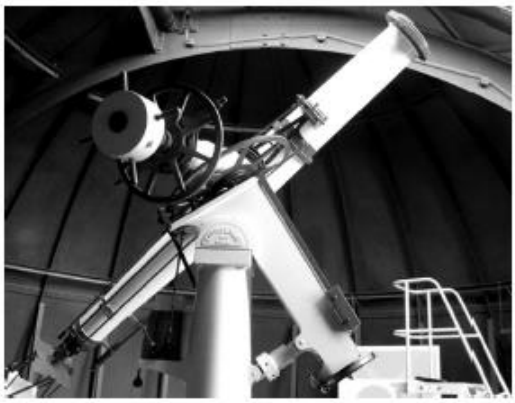
3

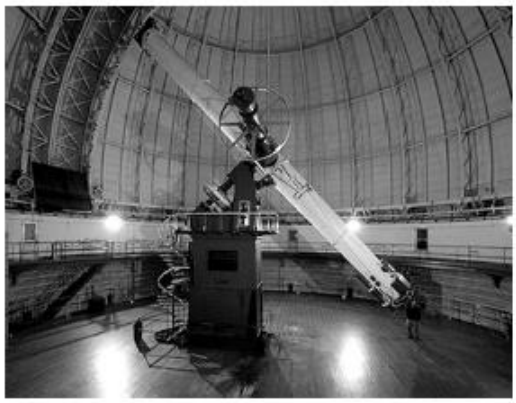
Total 24

End of Homework

Homework 6

1 The Mills Observatory in Dundee and the Yerkes Observatory in Wisconsin, USA both have refracting telescopes.





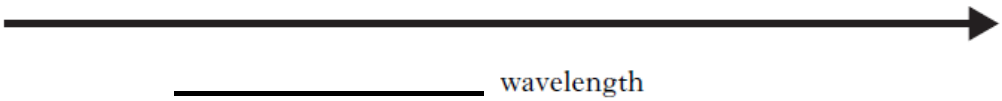
Astronomers in both observatories are studying the Andromeda galaxy which is approximately 2·2 million light years away.

a) A light year is defined as "*the distance that light travels in one year*".
Show by calculation that 1 light year = 9·4608 x 10^{15} m. **3**

b) Not all telescopes detect visible light.
Why are different kinds of telescope used to detect signals from space? **1**

2 All stars emit electromagnetic radiation. The diagram below shows the electromagnetic spectrum in order of increasing wavelength. The names of **three** of the radiations are missing.

Gamma rays	X-rays	**P**	Visible light	**Q**	**R**	TV and Radio



a) What does the arrow indicate about the wavelength of the radiations? **1**

b) Name radiation:

P

Q

R **3**

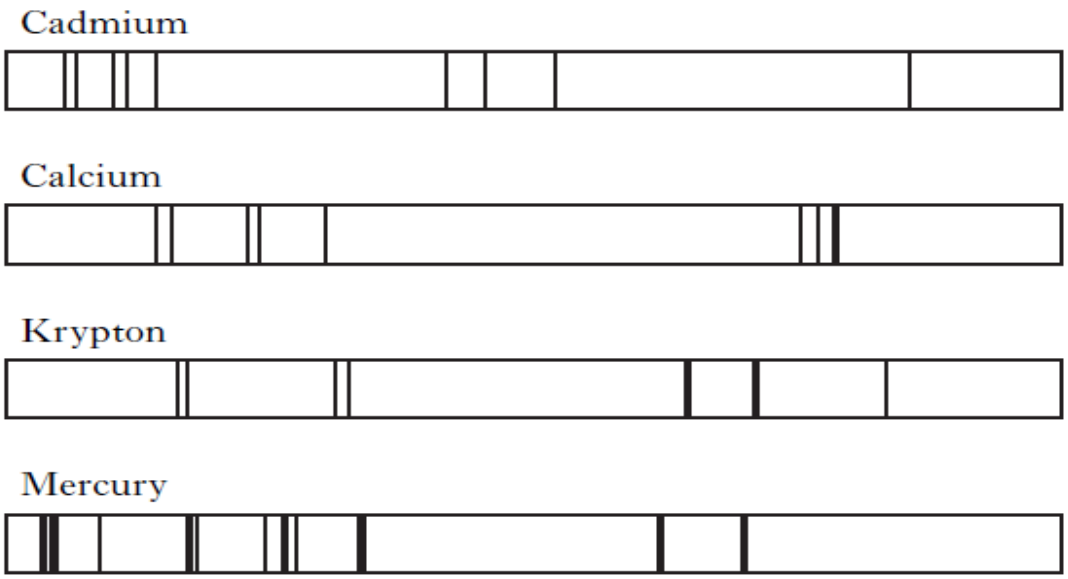
c) Suggest and explain one reason why ultraviolet radiation is more dangerous than visible light. **2**

Turn over

3 The spectra of radiation from a distant star is shown below.

a) What is this type of spectra called?

b) The spectra of a number of elements are also shown below.



Use the above spectrum to identify which of these elements are present in the distant star. **2**

4 Describe some risks and benefits of space exploration.

3

Total 15

End of Homework