

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	



General Certificate of Secondary Education  
Foundation Tier  
January 2010

# Physics

**PHY3F**

**Unit Physics P3**

**F**

**Written Paper**

**Wednesday 20 January 2010 9.00 am to 9.45 am**

**For this paper you must have:**

- a ruler.

You may use a calculator.

**Time allowed**

- 45 minutes

**Instructions**

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

**Information**

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

**Advice**

- In all calculations, show clearly how you work out your answer.



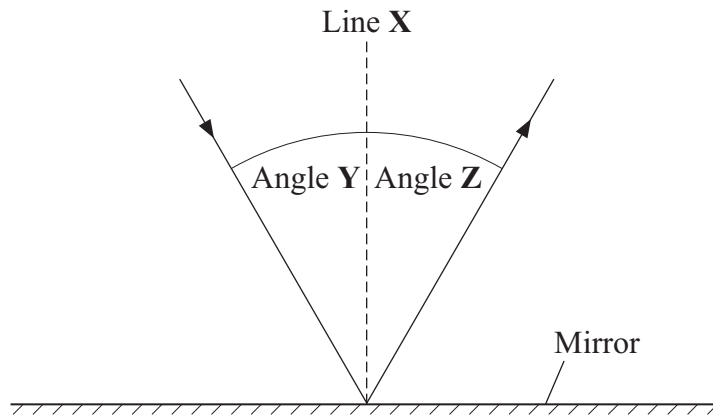
J A N 1 0 P H Y 3 F 0 1

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**PHY3F**

Answer **all** questions in the spaces provided.

- 1 (a) The following diagram shows a ray of light which is reflected by a mirror.



- 1 (a) (i) Use **one** word from the box to complete the sentence.

<b>concave</b>	<b>convex</b>	<b>plane</b>
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The mirror is a ..... mirror.  
(1 mark)

- 1 (a) (ii) Complete the sentence.

Line **X** is a vertical line at right angles to the mirror and is called the

.....

(1 mark)



Complete the following sentences by drawing a ring around the correct line in each box.

1 (a) (iii) Angle **Y** is called the angle of

incidence
reflection
refraction

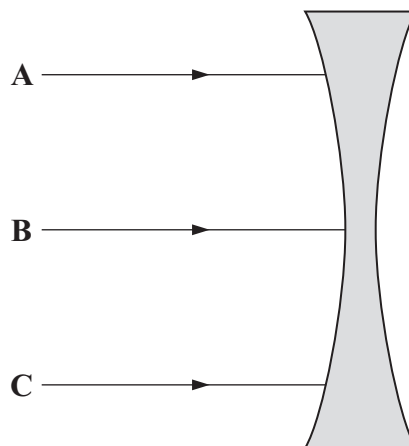
(1 mark)

1 (a) (iv) If angle **Y** is doubled, then angle **Z** will

be halved
stay the same
be doubled

(1 mark)

1 (b) The following diagram shows the side view of a lens and three parallel rays of light, **A**, **B** and **C**.



1 (b) (i) Use **one** word from the box to complete the sentence.

<b>converging</b>	<b>diverging</b>	<b>plane</b>
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The diagram shows a ..... lens.

(1 mark)

1 (b) (ii) Add to the diagram to show what will happen to **each** of the three rays of light, **A**, **B** and **C**.

(2 marks)

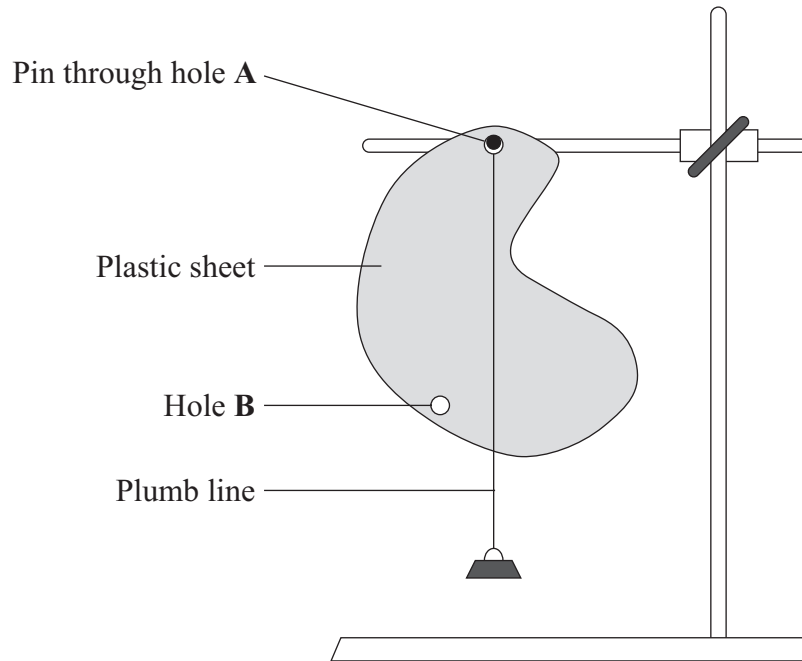


2 The diagram shows how a student can find the centre of mass of a thin flat sheet of plastic.

Part of his equipment is a plumb line. This is a weight fastened to one end of a piece of string.

He hangs the sheet and the plumb line from a pin through hole A.

2 (a) Mark an **X** on the diagram so that the centre of the **X** marks the likely position of the centre of mass of the plastic sheet.

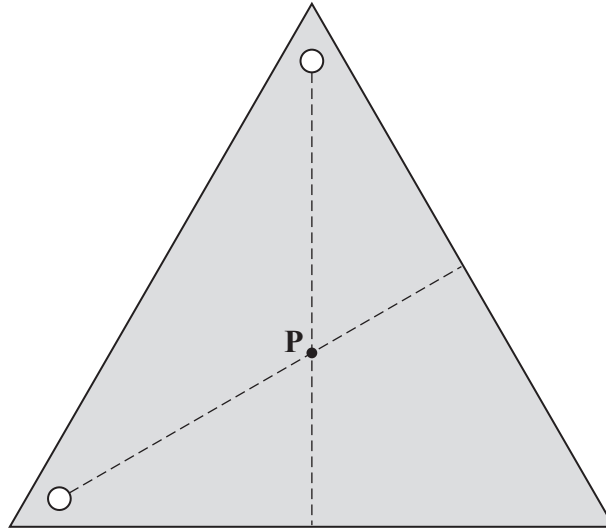


(1 mark)



- 2 (b) The dashed lines on the diagram below show the position of the plumb line from each hole when the student uses a different plastic sheet.

Point **P** is on both the dashed lines.



Complete the following sentence by drawing a ring around the correct line in the box.

Point **P** shows the

axis
centre of mass
moment
symmetry

of the plastic sheet.

(1 mark)

- 2 (c) Complete the following sentence by drawing a ring around the correct word in the box.

A plumb line always hangs so that it is

curved
horizontal
parallel
vertical

(1 mark)

3

Turn over ►

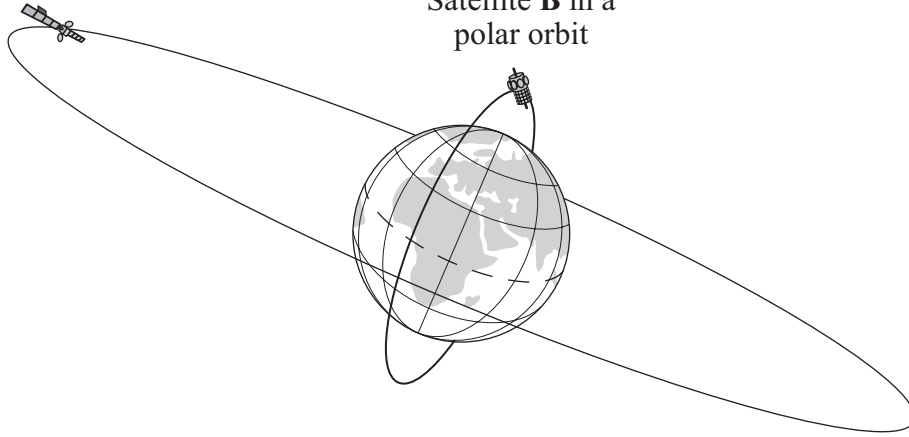


3 The diagram shows two satellites orbiting the Earth.

Both satellites have the same mass.

Satellite **A** in a  
geostationary orbit

Satellite **B** in a  
polar orbit



3 (a) Complete the following sentences by drawing a ring around the correct line in each box.

3 (a) (i) The time taken for one orbit by satellite **A** is 

less than
the same as
greater than

 the time taken for  
one orbit by satellite **B**.

(1 mark)

3 (a) (ii) The force of attraction between the Earth and satellite **A** is 

less than
the same as
greater than

 the  
force of attraction between the Earth and satellite **B**.

(1 mark)



3 (a) (iii) The gravitational force of attraction between the Earth and a satellite

provides a 

centripetal
cosmic
friction

 force.

(1 mark)

3 (a) (iv) The time taken for satellite A to complete one orbit is

24 hours
1 week
1 month
1 year

(1 mark)

3 (b) Use phrases from the box to complete the sentences.

<b>geostationary orbit</b>	<b>high polar orbit</b>	<b>low polar orbit</b>
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3 (b) (i) Communications satellites are usually put in a .....  
(1 mark)

3 (b) (ii) Monitoring satellites are usually put in a .....  
(1 mark)

6
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**Turn over for the next question**

**Turn over ►**



- 4 (a) The table gives information about the frequencies in the hearing ranges of six different mammals.

Name of mammal	Frequencies in hearing range
Bat	20 Hz → 160 kHz
Dog	20 Hz → 30 kHz
Dolphin	40 Hz → 110 kHz
Elephant	5 Hz → 10 kHz
Human	20 Hz → 20 kHz
Tiger	30 Hz → 50 kHz

- 4 (a) (i) Which mammal in the table can hear the highest frequency?

.....  
(1 mark)

- 4 (a) (ii) Which mammal in the table, apart from humans, **cannot** hear ultrasound?

.....  
(1 mark)

- 4 (a) (iii) Give **one** example of a frequency which an elephant can hear but which a tiger **cannot** hear.

Include the unit in your answer.

Frequency .....

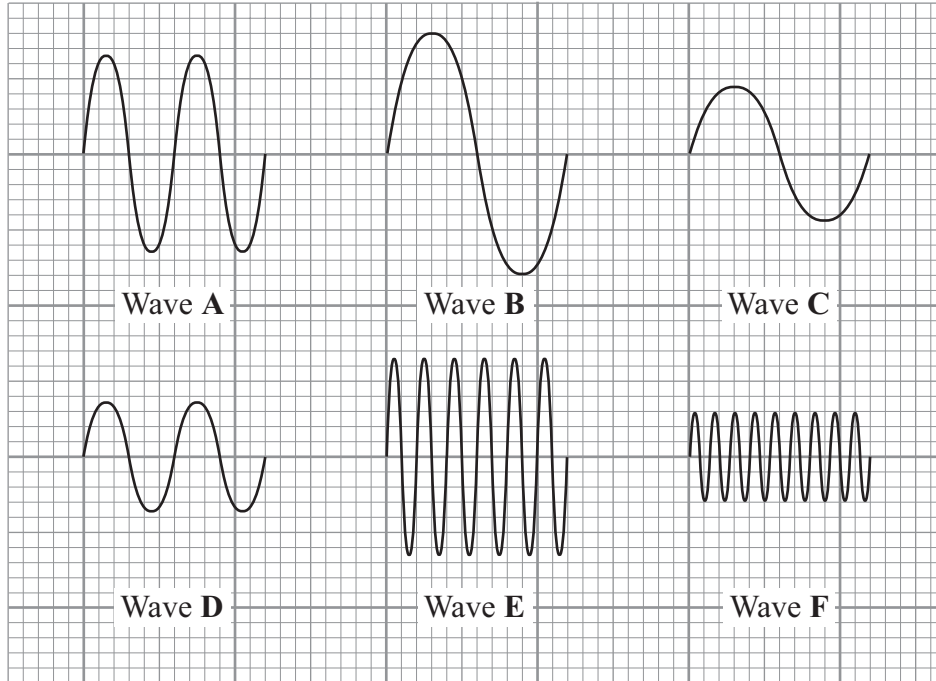
(1 mark)





- 4 (b) The diagrams show six sound waves, **A**, **B**, **C**, **D**, **E** and **F**, represented on an oscilloscope screen.

They are all drawn to the same scale.



- 4 (b) (i) Which **one** of the waves has the greatest amplitude?

Wave .....  
(1 mark)

- 4 (b) (ii) Which **one** of the waves has the highest frequency?

Wave .....  
(1 mark)

5
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**Turn over for the next question**

**Turn over ►**



5 (a) Complete the following sentences by drawing a ring around the correct word in each box.

5 (a) (i) Stars form when enough dust and gas from space is pulled together

by 

centripetal
gravitational
magnetic

 attraction.

(1 mark)

5 (a) (ii) Stars give out energy for millions of years by their nuclei

burning
joining
splitting

(1 mark)

5 (a) (iii) When gravitational forces balance radiation pressure, a star is

shrinking
stable
swelling

(1 mark)

5 (b) The Universe is made up of billions of galaxies.

5 (b) (i) What is a galaxy?

.....  
 .....

(1 mark)

5 (b) (ii) Name the galaxy which contains the Sun.

.....

(1 mark)

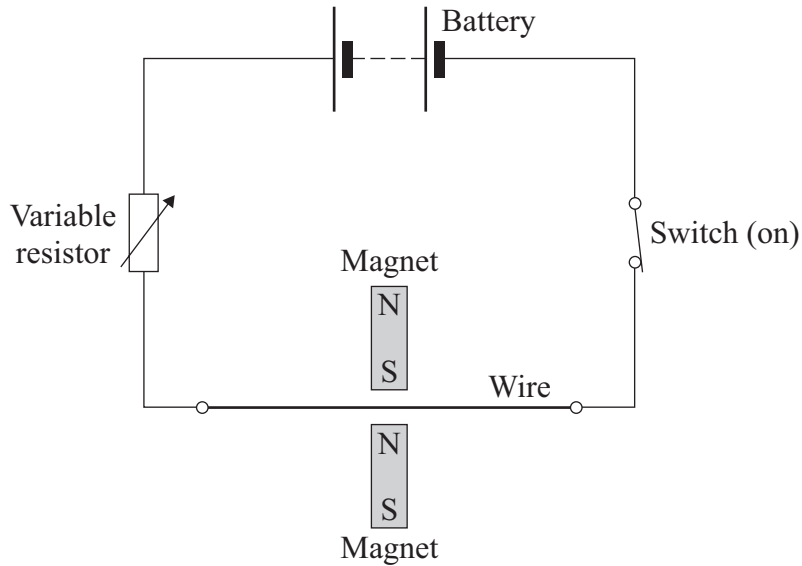
<b>5</b>



6 A student investigates the electromagnetic force acting on a wire which carries an electric current. The wire is in a magnetic field.

The diagram shows the circuit which the student uses.

6 (a) Draw an **X** on the diagram, with the centre of the **X** in the most strongest part of the magnetic field.



(1 mark)

6 (b) Give **one** change that she can make to the magnets to **decrease** the electromagnetic force on the wire.

.....  
 .....

(1 mark)

6 (c) The student wants to change the electromagnetic force on the wire without changing the magnets or moving their position.

6 (c) (i) Give **one** way in which she can **increase** the electromagnetic force.

.....  
 .....

(1 mark)

6 (c) (ii) Give **one** way in which she can **reverse** the direction of the electromagnetic force.

.....  
 .....

(1 mark)

4
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Turn over ►



- 7 A student collects data from the Internet about planets in the solar system. She arranges the data into a table.

Name of the planet	Distance from the Sun in millions of kilometres	Time taken for one orbit of the Sun in years	Time taken to spin on its axis in hours	Average temperature on the side facing the Sun in °C
Mercury	60	0.24	1400	+430
Venus	110	0.60	5800	+470
Earth	150	1	24	+20
Mars	230	2	25	-20
Jupiter	780	12	10	-150
Saturn	1400	30	10	-180
Uranus	2900	84	17	-220
Neptune	4500	160	16	-230

- 7 (a) Name the **two** variables in the student's table which **always** have the relationship:

As one increases, so does the other.

..... and .....  
(1 mark)

- 7 (b) (i) Give an example of **two** variables in the student's table which **generally** have the relationship:

As one increases, the other decreases.

..... and .....  
(1 mark)

- 7 (b) (ii) Which piece of data does not seem to fit the relationship in (b)(i)?

.....  
(1 mark)



7 (c) Scientists plan to launch a satellite which will orbit Mars above its equator. It will be a geostationary satellite.

How many hours will it take to orbit Mars?

..... hours  
(1 mark)

7 (d) Mars has two moons.

Neither of them is in a geostationary orbit and they both take different times to orbit the planet.

Which **one** of these statements is correct.  
Put a tick (✓) in the box next to your answer.

The two moons will always be above the same point on the surface of Mars.

The two moons will be in different positions at different times.

You can never see both moons at the same time.

(1 mark)

7 (e) Use words from the box to complete the **three** spaces in the passage.

**circular      direction      friction      gravitational      speed      universal**

The moons of the planet Neptune move in circular paths around the planet.

They continuously accelerate towards the centre of Neptune.

The acceleration changes the ..... of each moon but does not change its ..... The force causing the acceleration is a ..... force.

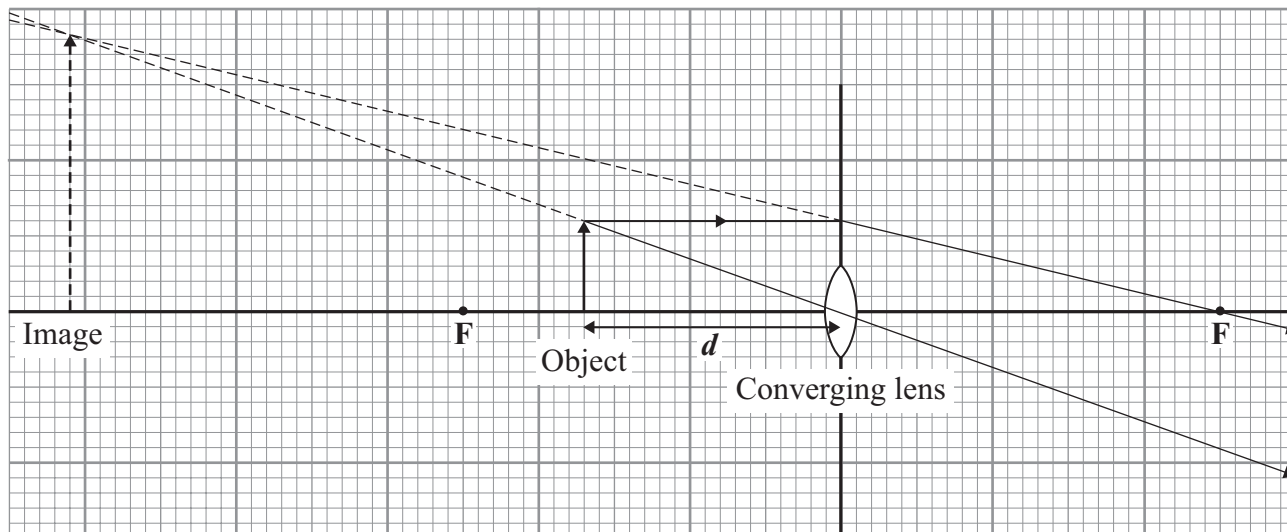
(2 marks)

Turn over ►



8 A student investigates how the magnification of an object changes at different distances from a converging lens.

The diagram shows an object at distance  $d$  from a converging lens.



8 (a) (i) The height of the object and the height of its image are drawn to scale.

Use the equation in the box to calculate the magnification produced by the lens shown in the diagram.

$\text{magnification} = \frac{\text{image height}}{\text{object height}}$
---

Show clearly how you work out your answer.

.....

.....

.....

Magnification = ..... (2 marks)

8 (a) (ii) The points **F** are at equal distances on either side of the centre of the lens.

State the name of these points.

..... (1 mark)



**8 (a) (iii)** Explain how you can tell, **from the diagram**, that the image is virtual.

.....  
.....

*(1 mark)*

**Question 8 continues on the next page**

**Turn over ►**



- 8 (b) The student now uses a different converging lens. He places the object between the lens and point **F** on the left.

The table shows the set of results that he gets for the distance  $d$  and for the magnification produced.

Distance $d$ measured in cm	Magnification
5	1.2
10	1.5
15	2.0
20	3.0
25	6.0

His friend looks at the table and observes that when the distance doubles from 10 cm to 20 cm, the magnification doubles from 1.5 to 3.0.

His friend's conclusion is that:

The magnification is directly proportional to the distance of the object from the lens.

His friend's observation is correct but his friend's conclusion is **not** correct.

- 8 (b) (i) Explain, with an example, why his friend's conclusion is **not** correct.

.....

.....

.....

.....

(2 marks)

- 8 (b) (ii) Write a correct conclusion.

.....

.....

(1 mark)





- 8 (b) (iii) The maximum range of measurements for  $d$  is from the centre of the lens to **F** on the left.

The student **cannot** make a correct conclusion outside this range.

Explain why.

.....  
.....

(1 mark)

8
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**END OF QUESTIONS**



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