
Centre Number

Student Number

Year 12 Physics

Assessment Task 2
Mid-Course Examination

General Instructions

- Reading time: 5 minutes
- Working time 120 minutes
- Write using blue or black pen
- You may use a pencil to draw or complete diagrams
- Attempt ALL questions
- Calculators may be used

Total marks – 65

Section 1 – 20 marks

Multiple choice
Questions 1-20

Section 2 - 45 marks

Extended answers
This section contains questions 21-28

Answer all questions in the spaces provided, showing all working where necessary.

Instructions for Section 1

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

If you have changed your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:

Section 1 – Multiple Choice

20 marks

Attempt Questions 1-20
Allow about 35 minutes for this section

Use the multiple choice answer sheet provided by shading the letter corresponding to the best answer on the answer sheet provided.

Question 1

Which statement about the weight of an object is correct?

(A) If gravitational acceleration is zero, then weight of the object is maximum.
(B) The weight of a particular object is constant on a particular planet.
(C) The weight of an object will change when it is taken to a different planet.
(D) Weight is independent of the value of the acceleration due to gravity.

Question 2

A planet has a smaller gravitational field strength on its surface than does the Earth. Which combination from the table below best predicts the planet's radius and mass when compared with those of the Earth?

	Radius	*Mass*
(A)	Smaller than Earth's	Larger than Earth's
(B)	Smaller than Earth's	Equal to Earth's
(C)	Larger than Earth's	Equal to Earth's
(D)	Equal to Earth's	Larger than Earth's

Question 3

Which of the following situations describes a system in which the person is losing gravitational potential energy?

(A) A boy jumping down from a tree branch
(B) A girl stretching a spring horizontally
(C) A cyclist riding up a steep hill
(D) An astronaut in a rocket rising vertically from Earth

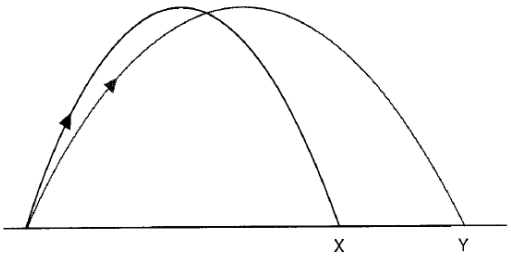
Question 4

The Lam Han Space Probe is in orbit a distance R from the centre of the Earth. At this height it has gravitational potential energy equal to $-10E$ joules. The space probe is then moved to another orbit where its gravitational potential energy is $-E$ joules. Which statement about the Lam Han Space Probe is correct?

(A) It is in a higher orbit and work has been done on it by gravity.
(B) It is in a lower orbit and work has been done on it by its engines.
(C) It is in a lower orbit and work has been done on it by gravity.
(D) It is in a higher orbit and work has been done on it by its engines.

Question 5

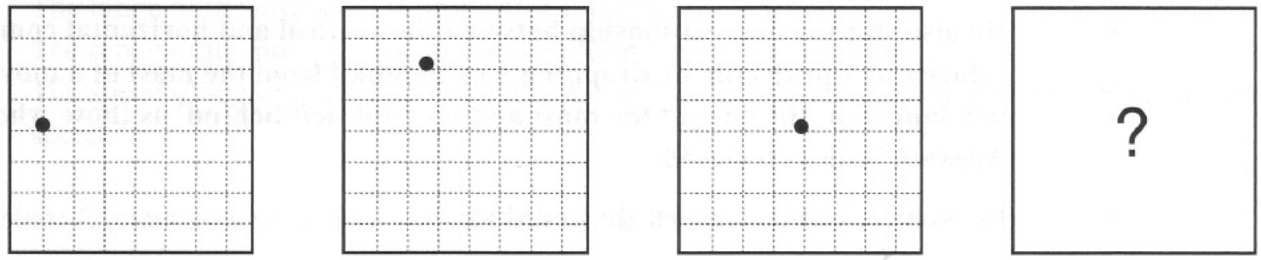
The diagram below shows that paths of two projectiles, X and Y. Which of the following are different for X and Y?



(A) Their accelerations.
(B) Their times of flight.
(C) Their maximum vertical displacements.
(D) Their initial velocities.

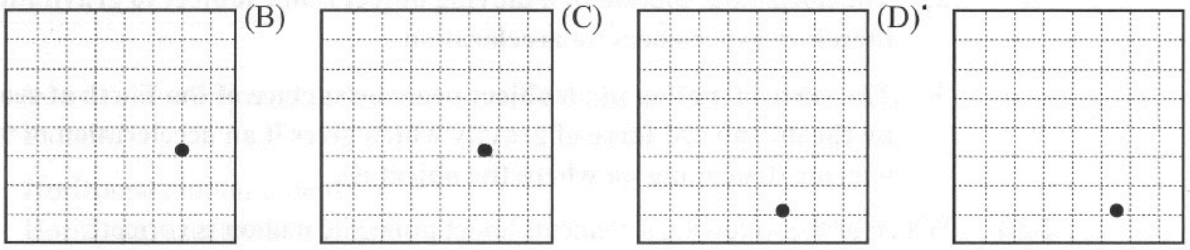
Question 6

Some photographs were taken of a ball moving in a parabolic path in front of a grid. The time interval between each photograph was identical. The diagrams show the first three photographs of the ball's flight.



Which choice correctly shows the next photograph in the series?

(A) (B) (C) (D)



Question 7

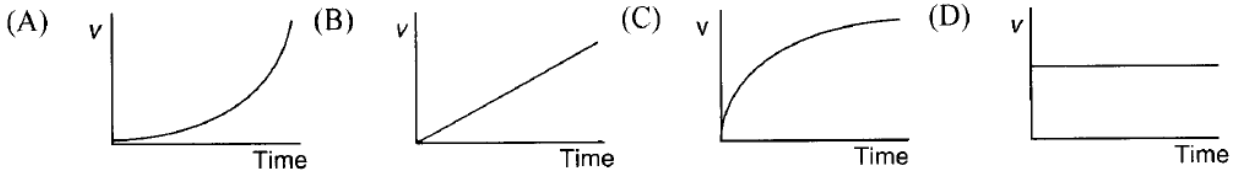
According to Newton, how does the shape of the path of a canon ball launched from the top of a high mountain change as the launch velocity is progressively increased?

(A) The path changes from parabolic, to circular, then to linear.
(B) The path changes from parabolic, to circular, then to elliptical.
(C) The path remains parabolic.
(D) The path changes from parabolic to linear.

Question 8

Which graph best describes the motion of a rocket as it takes off with a constant thrust?

(A) (B) (C) (D)



Question 9

A centripetal force, F, acts on a rock made to undergo circular motion at the end of a string. What is the magnitude of the new centripetal force if the speed of the rock were to double and other factors remain unchanged?

(A) $\frac{F}{2}$
(B) $2F$
(C) $4F$
(D) $8F$

Question 10

Satellite X has an orbital period that is twice that of satellite Y. Which statement about these satellites is correct?

(A) X is moving slower and at a lower altitude than Y.
(B) X is moving faster and at a lower altitude than Y.
(C) X is moving slower and at a higher altitude than Y.
(D) X is moving faster and at a higher altitude than Y.

Question 11

A student holds a piece of string with a bag of marbles attached to the other end. Which of the following changes in motion or position would cause a decrease in the apparent weight of the bag of marbles?

(A) Pulling the bag so that it accelerates upwards.
(B) Lowering the bag so that it accelerates downwards.
(C) Changing to a location where there is a greater density in the underlying rock.
(D) No change in motion can alter the weight.

Question 12

The table below shows information for two moons, Maddie and Leine, orbiting the planet Carr.

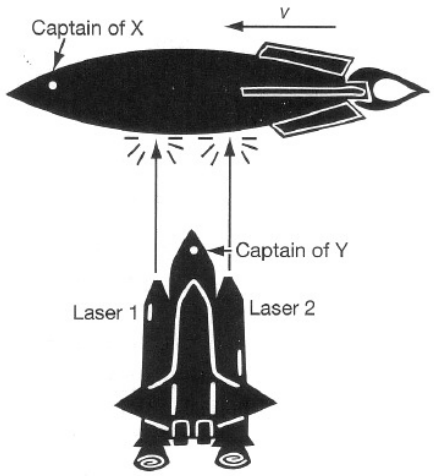
Moon	Radius of Orbit (km)	Orbital Period (days)
Maddie	100 000	2.0
Leine	400 000	*T*

What is the orbital period of Leine?

(A) 1.4 days
(B) 4.0 days
(C) 16 days
(D) 32 days

Question 13

Spaceship Y fires its two laser canons simultaneously at rebel spaceship X as it flies past at 0.5c.

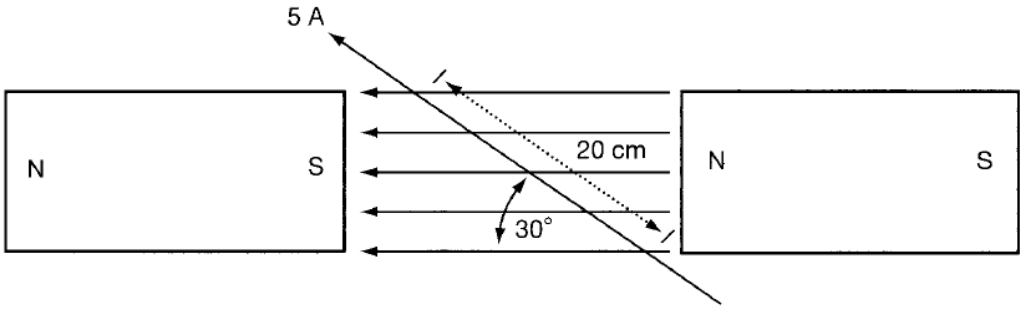


Which statement about this event is correct?

(A) The captain of X sees laser 1 hit before laser 2.
(B) The captain of X sees both lasers hit at the same time.
(C) The captain of Y sees laser 2 hit before laser 1.
(D) The captain of Y sees laser 1 hit before laser 2.

Question 14

The diagram shows a current-carrying conductor carrying 5 A of electricity between the poles of a pair of magnets which produce a magnetic field of intensity 0.4 T. As shown, the length of the conductor within the magnetic field is 20 cm.

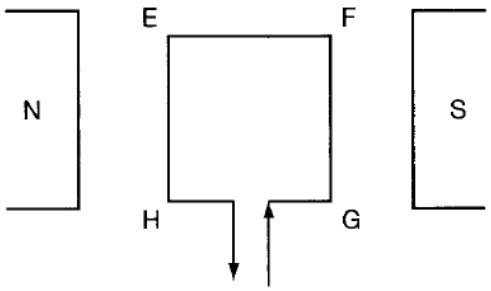


What is the force on the conductor due to the magnetic field?

(A) 0.2 N out of the page
(B) 0.2 N into the page
(C) 20 N out of the page
(D) 20 N into the page

Question 15

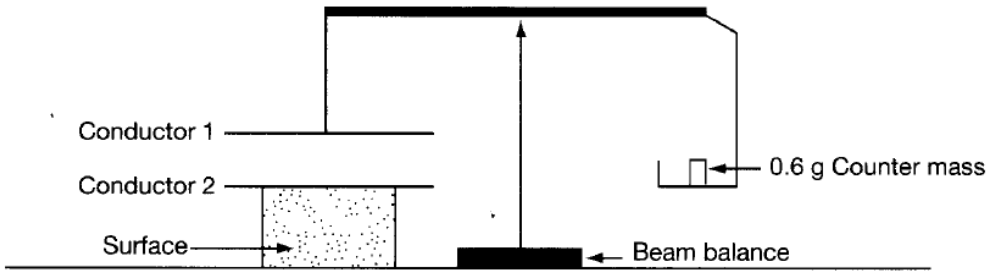
Consider a current-carrying coil in a magnetic field as shown. Which statement correctly compares the forces acting on sides EF and GH?



(A) The forces are equal in magnitude but opposite in direction.
(B) The forces are equal in magnitude and in the same direction.
(C) The force on EF is greater than the force on GH and in the opposite direction.
(D) No forces act on sides EF and GH.

Question 16

The diagram shows a beam balance that supports one current-carrying conductor. A second current carrying conductor rests on a surface 0.5 cm below the first. The conductors have a common parallel length of 0.8 m. The balance is 'balanced' initially. When the same current flows through each of the wires, a 0.6 gram counter mass is needed to restore the balance.

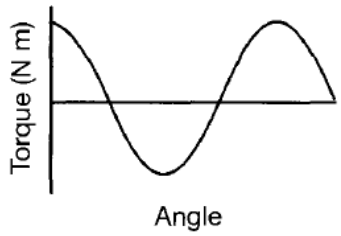


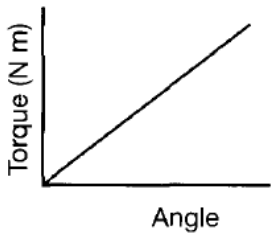
Calculate the force experienced by the Conductor 1 when the current is flowing.

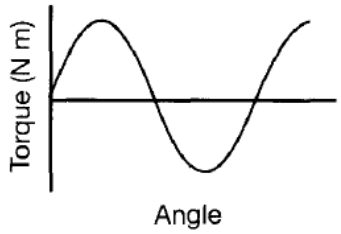
(A) 4.70×10^{-3} N upwards
(B) 4.70×10^{-3} N downwards
(C) 5.88×10^{-3} N upwards
(D) 5.88×10^{-3} N downwards

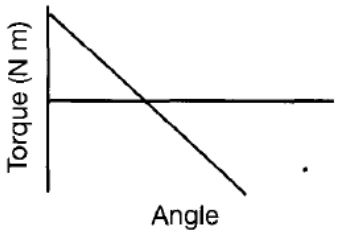
Question 17

Which graph best shows the relationship between the torque on a current-carrying coil and the angle the coil makes with the magnetic field lines when the plane of the coil is initially vertical (perpendicular to the field)?

(A)


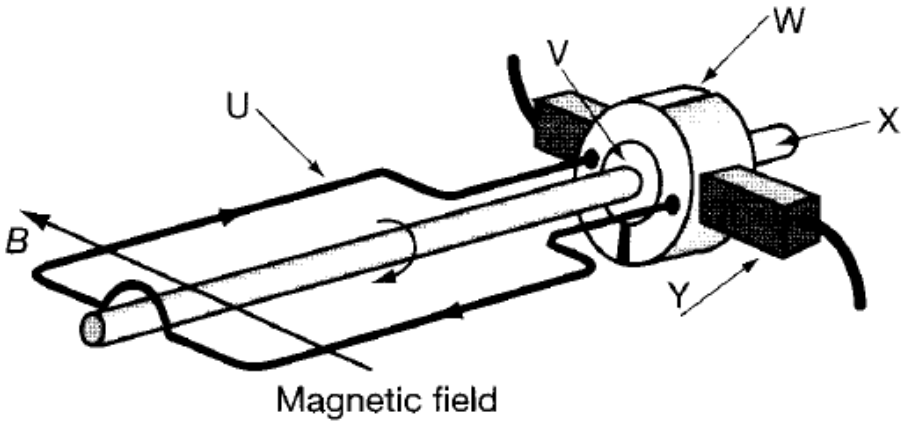
(B)


(C)


(D)


The simplified diagram of a DC motor below refers to Questions 18 and 19.

The directions of the magnetic field and current are shown.



Question 18

Which choice correctly identifies each labelled component of this motor?

	U	W	X	Y
(A)	Current	Commutator	Armature	Brush
(B)	Coil	Rotor	Axle	Commutator
(C)	Coil	Armature	Core	Commutator
(D)	Coil	Commutator	Axle	Brush

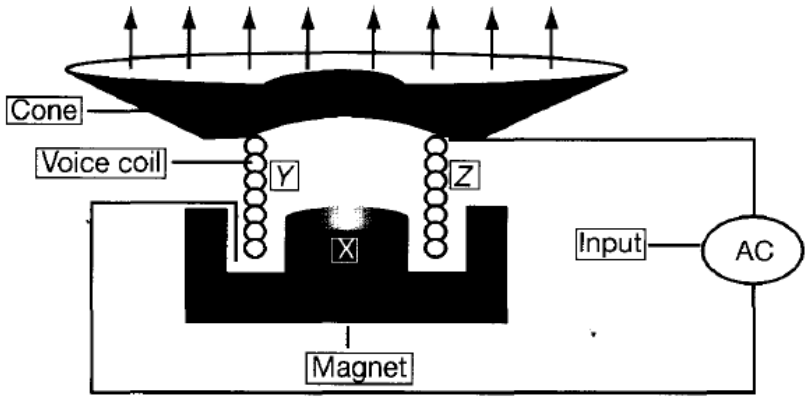
Question19

Which choice correctly identifies the component labelled V and its function in the diagram above?

(A) Conducting ring to join the two halves of the commutator
(B) Insulating disc to prevent short-circuiting of the coil
(C) Conducting ring to connect the coil to the commutators
(D) Insulating disc to stop the coil from touching the commutators

Question 20

Consider the schematic diagram of a loudspeaker shown below.



If the loudspeaker was about to expand the cone and push air upwards as shown by the arrows above the speaker, which statement about the pole of the field magnet X and the direction of the current in the coils labelled Y and Z is correct?

	X	Y	Z
(A)	North	Into the page	Out of the page
(B)	North	Out of the page	Into the page
(C)	South	Into the page	Into the page
(D)	South	Out of the page	Out of the page

This page intentionally left blank

Kincoppal Rose Bay
2011 Half-Yearly Examination

Centre Number

Physics

Student Number

Section 2 - 45 marks

Attempt Questions 21-28
Allow about 60 minutes for this section

Show all relevant working in questions involving calculations. Answer the questions in the spaces provided. These spaces provide guidance for the expected length of the response.

Marks

Question 21 (8 marks)

Anna devised an experiment to determine the acceleration due to gravity where she dropped a golf ball from different heights and used a stopwatch to measure the time it took to fall to the ground.

The results of Anna's experiment are shown in the table below.

Height (m)	Time (s)	Time^2 (s^2)
1.0	0.42	
1.2	0.54	
1.4	0.53	
1.6	0.56	
1.8	0.58	
2.0	0.64	

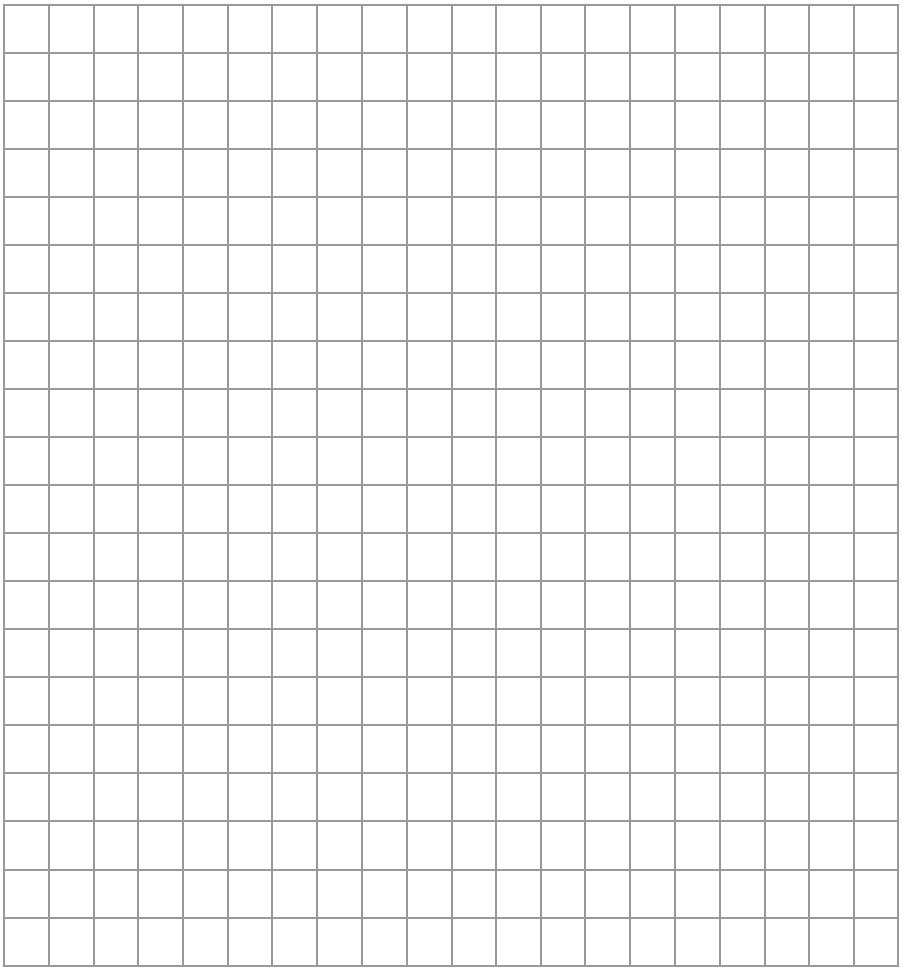
(a) Complete the table showing the values for time squared. **1**

This page intentionally left blank

Marks

Question 21 continued

(b) Plot a graph of height versus time squared and draw a line of best fit to show the relationship between the two variables. **3**



(c) Use the graph to and an appropriate equation of motion to determine the acceleration due to gravity. **2**

…….

…….

…….

…….

Marks

Question 21 continued

(d) Assess the reliability of the data gathered in this experiment. **2**

…….

…….

…….

…….

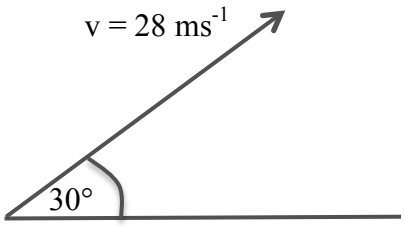
…….

…….

Marks

Question 22 (5 marks)

In a valiant attempt to demonstrate the principles of projectile motion, Sally allowed herself to be used as a human cannonball. Wearing a full crash suit and helmet, she was fired at an angle of 30° to the horizontal with an initial velocity of 28 ms^{-1}.



(a) Ignoring air resistance, calculate Sally's maximum horizontal displacement (range). **3**

……

……

……

……

……

……

(b) If this experiment had been repeated on the surface of the moon, explain how and why Sally's range would change. **2**

……

……

……

……

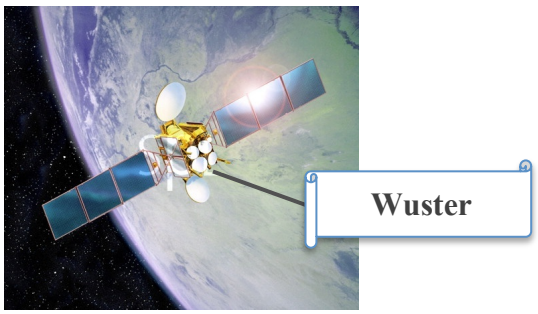
……

……

Marks

Question 23 (6 marks)

In 2012, NASA's newest satellite, the Wuster, will be placed into an orbit around the Earth with an altitude of 1500 km.



(a) Calculate the gravitational potential energy of the satellite if it has a mass of 1500 kg and the radius of the Earth is 6378 km. **2**

……

……

……

……

(b) Account for the orbital decay of this satellite and describe changes to its energy and motion as a result. **4**

……

……

……

……

……

……

……

……

Marks

Question 24 (4 marks)

Sophie the astronaut notices that during a rocket launch she feels increasingly heavier as the altitude of her rocket increases. Account for the increase in her apparent weight by analysing the forces acting on her as the rocket ascends. **4**

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

Marks

Question 25 (6 marks)

The Moon orbits around the Earth once every 28 days an approximately circular orbit. The average distance between the centre of the Moon and the Earth is 384 403 km.

(a) Derive an equation for the Moon's orbital velocity around the Earth. **3**

……

……

……

……

……

……

(b) Calculate the Moon's orbital velocity around the Earth. **2**

……

……

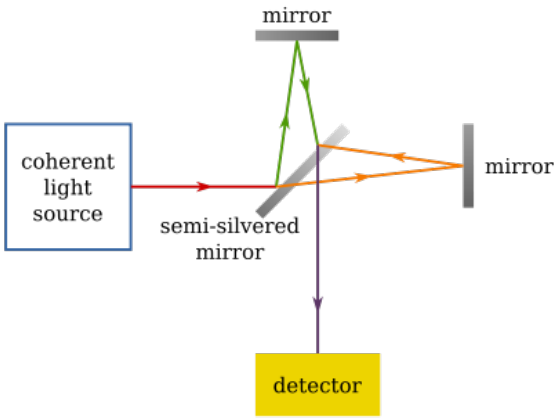
……

……

Marks

Question 26 (5 marks)

The diagram below illustrates how light was used by Michelson and Morley to measure the speed of light relative to the ether.



(a) Outline Michelson and Morley's experiment to detect the presence of the ether. **3**

……

……

……

……

……

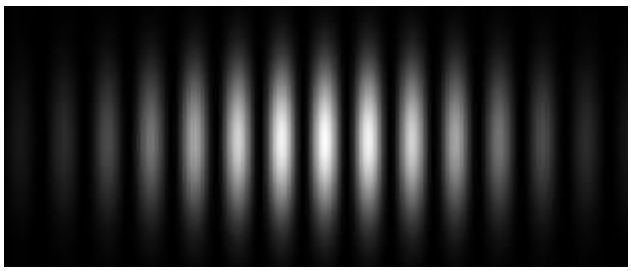
……

……

……

Question 26 continued

(b) The photograph below shows the typical interference pattern for light waves that are travelling in phase. **2**



Explain the role of this interference pattern in Michelson and Morley's experiment.

……

……

……

……

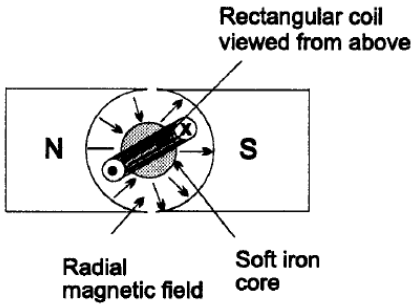
……

……

Marks

Question 27 (4 marks)

A rectangular coil, 10 cm x 20 cm, consisting of 500 turns is placed in a radial magnetic field of intensity 0.5 T as shown below. A current of 2.0 A flows in the coil.



(a) Calculate the torque acting on the coil. **2**

……

……

……

……

(b) Explain the advantage of using a radial magnetic field. **2**

……

……

……

……

……

……

Marks

Question 28 (7 marks)

Sam decides to test some of the predictions of the Theory of Special Relativity by swimming 1000 m at constant velocities near the speed of light. In an interesting experiment, Professor Williams acts as an observer and measures the quantities of time taken, Sam's height and her mass from another inertial reference frame as Sam swims each trial. As a control, Sam swims the first 1000 m at a constant velocity of 10 ms^{-1}. The results of this experiment are shown in the table below.

Trial	Speed (ms^{-1})	Time (s)	Sam's Height (m)	Sam's Mass (kg)
Control	10	100	1.60	65
1	0.7c	140	?	91
2	0.8c	167	0.96	108
3	0.9c	229	0.70	149

(a) For the first trial, Professor Williams was momentarily distracted by another swimmer and did not record a result. Calculate Sam's observed height for Trial 1. **2**

……

……

……

……

Question 28 continued **Marks**

(b) Account for Sam's observed increase in mass as her velocity increases. **5**

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

End of paper

Kincoppal Rose Bay
2011 Half-Yearly Examination

Centre Number

Physics

Student Number

Multiple Choice Answer Sheet

Question	**1**	A ⬭	B ⬭	C ⬭	D ⬭
	2	A ⬭	B ⬭	C ⬭	D ⬭
	3	A ⬭	B ⬭	C ⬭	D ⬭
	4	A ⬭	B ⬭	C ⬭	D ⬭
	5	A ⬭	B ⬭	C ⬭	D ⬭
	6	A ⬭	B ⬭	C ⬭	D ⬭
	7	A ⬭	B ⬭	C ⬭	D ⬭
	8	A ⬭	B ⬭	C ⬭	D ⬭
	9	A ⬭	B ⬭	C ⬭	D ⬭
	10	A ⬭	B ⬭	C ⬭	D ⬭
	11	A ⬭	B ⬭	C ⬭	D ⬭
	12	A ⬭	B ⬭	C ⬭	D ⬭
	13	A ⬭	B ⬭	C ⬭	D ⬭
	14	A ⬭	B ⬭	C ⬭	D ⬭
	15	A ⬭	B ⬭	C ⬭	D ⬭
	16	A ⬭	B ⬭	C ⬭	D ⬭
	17	A ⬭	B ⬭	C ⬭	D ⬭
	18	A ⬭	B ⬭	C ⬭	D ⬭
	19	A ⬭	B ⬭	C ⬭	D ⬭
	20	A ⬭	B ⬭	C ⬭	D ⬭