MARKER CODE

Student Personal Identification Number

SOLOMON ISLANDS NATIONAL FORM SIX CERTIFICATE

PHYSICS

2017

QUESTION and ANSWER BOOKLET

Time allowed: Three hours

INSTRUCTIONS

1. In addition to this Question and Answer Booklet you should also have a PHYSICS EQUATION SHEET (No. 9/2).

2. This paper consists of TWO sections: Sections A and B. Both sections are compulsory.

Section A: 160 marks 135 minutes

- **Answer ALL questions.**
- **There are ten Questions worth 16 marks each.**
- **Write your answers in the spaces provided in this Booklet.**
- **Marks are awarded for working, so show your calculations clearly.**

Section B: 40 marks 45 minutes

- **There are twenty Multiple Choice Questions each worth 2 marks.**
- **Write your answers in this section on the foldout flap at the back of this booklet.**

If you are unable to calculate a value for a question and you need that value in a later question, select a convenient value and use it where needed.

3. Write your Student Personal Identification Number (SPIN) in the box on the top right hand corner of this page and on the fold-out flap.

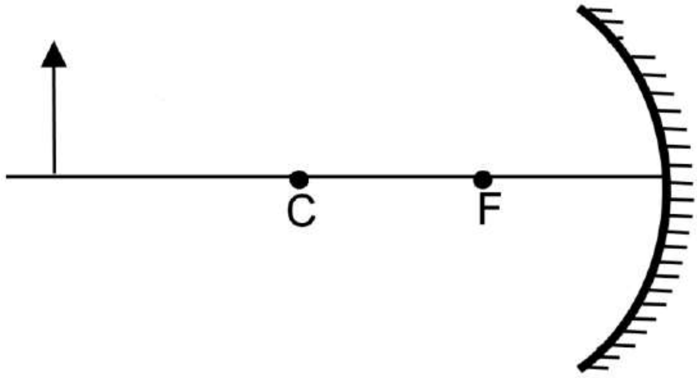
TOTAL MARKS 200

SECTION A **[160 MARKS]**

ATTEMPT ALL QUESTIONS IN THIS SECTION
WRITE THE ANSWER TO EACH QUESTION IN THE SPACE PROVIDED FOR THE QUESTION. IF YOU ARE NOT ABLE TO CALCULATE A VALUE FOR A QUESTION AND YOU NEED THAT VALUE IN A LATER QUESTION, SELECT A CONVENIENT VALUE AND USE IT WHERE NEEDED. Use $g = 9.81\ m/s^2$.where required.

QUESTION 1: **[16 MARKS]**

A. An object is positioned in front of a concave mirror as shown in the diagram below.



I. In the diagram above, draw at least **two** light rays and locate and draw the image.

(3 marks)

II. The image formed by the mirror is
   a. real / virtual,
   b. upright / inverted
   c. diminished / magnified
   (circle your answers)

(3 mark)

B. A 4-cm tall light bulb is placed a distance of 45.7cm from a double convex lens having a focal length of 15.2cm.

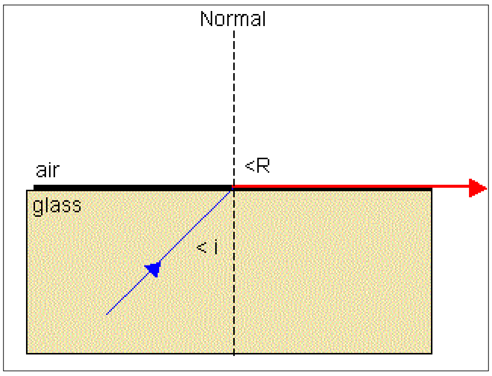
I. Using the appropriate formulae, determine the image distance.

(2marks)

II. Determine the size of the image formed.

(2 marks)

C. The diagram below shows a light ray travelling through two different media.



I. Explain your observation of the path taken by the light ray.

____
____
____
(2 marks)

II. If the incidence angle is increased, what will the observation now be?

____
____
____
(2 marks)

D. The refractive index of glass is n_{glass} = 1.52, n_{air} = 1.0.

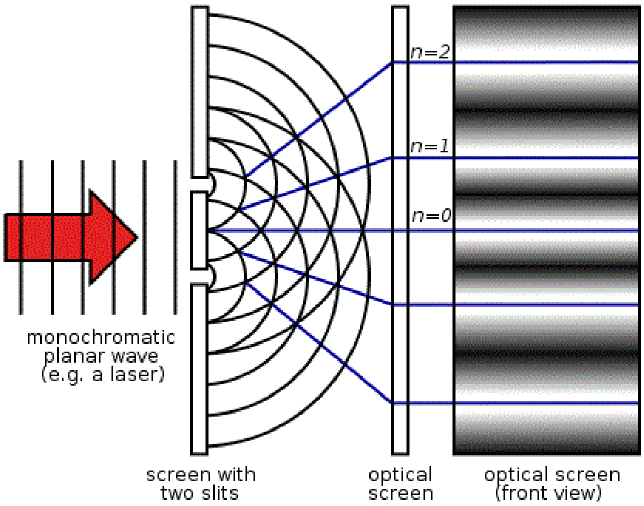
I. Calculate the critical angle of the glass

(2 marks)

Q1	
16	

QUESTION 2: **[16 MARKS]**

A. The diagram below shows waves that travel through a double slit as shown in the diagram below



I. From the diagram above clearly mark any wavelengths.

(1 mark)

II. If the distance between two corresponding crests of one of the sources is 10 cm, what will be the frequency of any waves generated if the waves travel at the speed of 20m/s?

(2 marks)

III. Calculate the period of wavefronts.

(2 marks)

IV. If the wavelength of wave is increased, what effect will it have on the size of the frequency of the wave? Explain your answer.

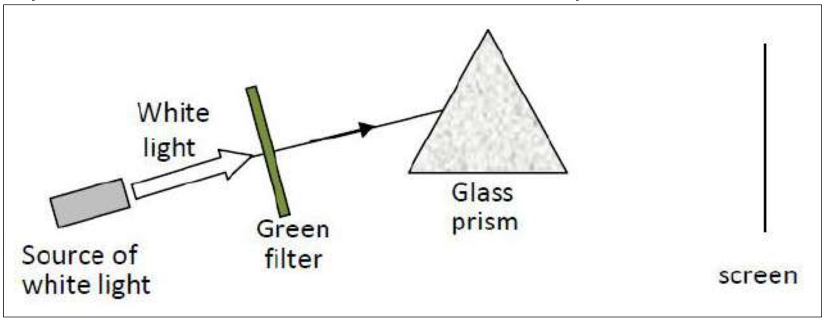
____

____

____

(2 marks)

B. A green filter is placed in the path of a beam of white light from a source. The light from the filter is made to pass through a glass prism. Draw the path of the ray through the prism and then to the screen at a point Y.



I. A yellow filter is now used instead of the green filter. On the diagram draw the ray from the yellow filter until it strikes the screen at a point X.

(2 marks)

II. Explain briefly why the white light is dispersed to form a spectrum on the sreen. Which colour is bent the least by the prism.

____

____

____

(2 marks)

C. Light has both particle and wave nature.

I. What is a photon?

____

____

(1 mark)

II. Briefly explain how the photon idea strengthens the belief in the dual nature of light.

____

____

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(2 marks)

III. Explain the dual nature of light. Use example to support your answer.

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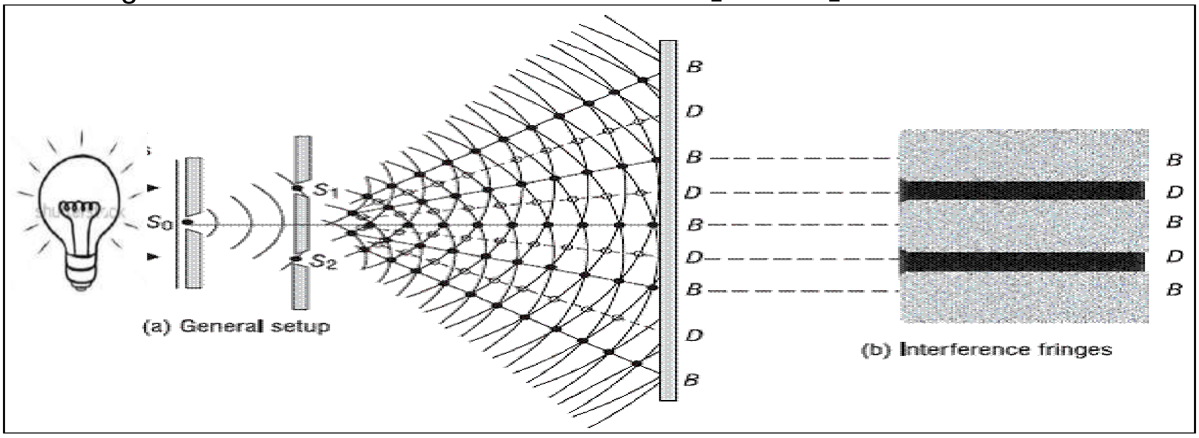
(2 marks)

Q2	
16	

QUESTION 3: **[16 MARKS]**

A. The diagram below is a schematic demonstration of Young's Double Slit experiment. The distance from the slits to the screen is 3m and the wavelength is of the light 200 nm. The distance between $\mathbf{S_1}$ and $\mathbf{S_2}$ is 0.3mm.



I. Calculate the distance between two dark bands.

(2 marks)

II. Calculate the distance of the 3rd bright fringe from the central maximum?

(2 marks)

III. What will happen to the distance between fringes if the light source is being replaced by another light source with smaller wavelength?

____

____

(2 marks)

B. The picture below shows a ball rolling up and back down an inclined plane.

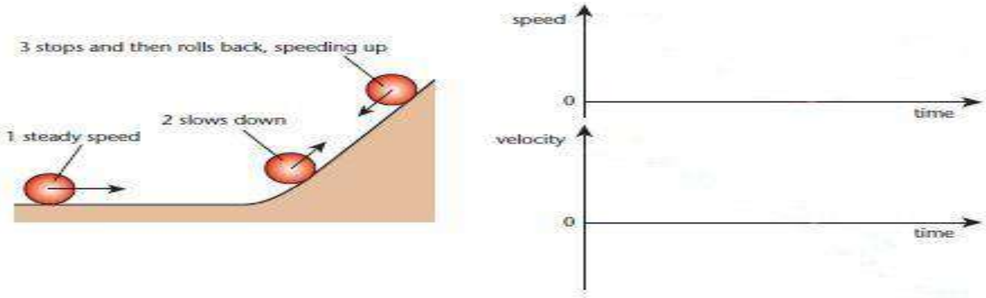


Fig. 9.3 Graphs for a ball that rolls up a hill, slows, and rolls back down, speeding up.

I. On the graph next to the diagram, draw the speed-time and velocity-time graphs. Label areas of graph with numbers as in diagram.

(4 marks)

II. Explain the difference between speed and velocity for part 3 of the ball's motion. You may use a figure to explain your answer.

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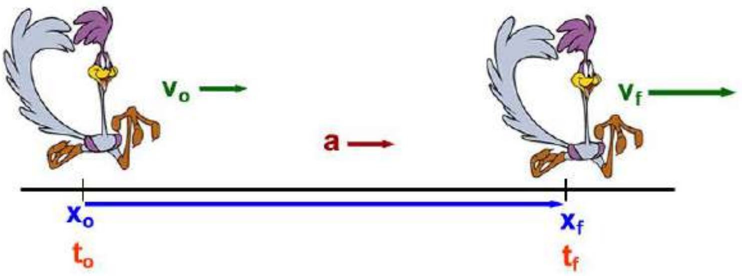
(2 marks)

C. A race duck accelerates uniformly from 5.5m/s to 15.1 m/s in 4.50s.



I. What is the duck's acceleration?

(2 marks)

II. How far has the duck travelled?

(2 marks)

Q3	
16	

QUESTION 4: **[16 MARKS]**

A. A boat is heading due north as it crosses a wider river at a velocity of 10km/hr. The river has a constant velocity of 5km/hr due east.

I. Draw a vector diagram to show the movements of the boat with respect to the velocity of the water.

(3 marks)

II. Determine the velocity of the boat with respect to the observer on the river bank.

(3 marks)

III. How would the driver get the boat directly to the opposite bank of the river if he had known the speed of the river before departing?

(2 marks)

B. The man pushed a 30 kg Lawn mower to cut grass around his house at a speed of 0m/s to 2m/s in 8 seconds as shown in the diagram below.

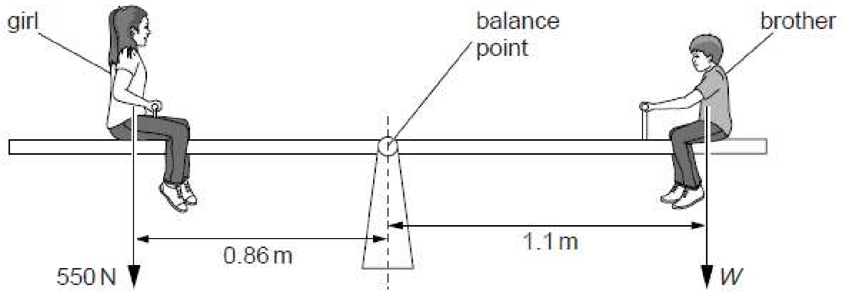
I. Calculate the acceleration of the mower within the 8 seconds.

(2 marks)

II. How much force is required to accelerate the mower from its resting position?

(2 marks)

C. A girl of weight 550N is playing on a see-saw with her brother of weight W sitting 1.1m to the right of the balance point. The see-saw is balanced when the girl sits 0.86m to the left of the balance point.



I. Calculate W.

(2 marks)

II. The girl and her brother slide equal distances along the see-saw away from each other. Describe and explain what happens.

____

____

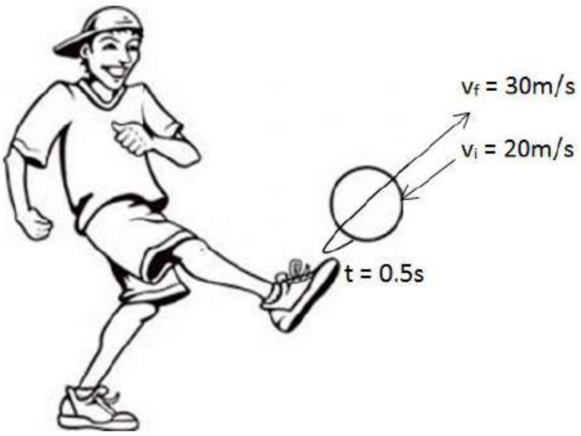
____

(2 marks)

Q4	
16	

QUESTION 5: **[16 MARKS]**

A. A ball of mass 0.5kg is kicked towards a boy at 20m/s. He then kicks it. It took the ball 0.5s on the boy's foot before flying off in the opposite direction at 30m/s.



I. Calculate the momentum of the ball before the boy kicks it.

(2 marks)

II. Calculate the change in momentum of the ball.

(2 marks)

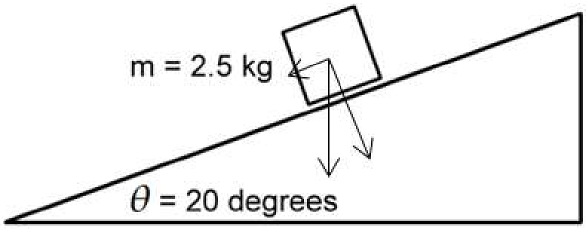
III. Calculate the force the boy applied with his feet to change the momentum of the ball.

(2 marks)

IV. If lesser force is applied by the boy to kick off the ball, how will this affect the time it took to change the momentum of the ball?

(2 marks)

B. A box of m=2.5kg is allowed to slide freely down an incline surface that makes 25 ^{o} with the horizontal surface as shown.



I. Calculate the weight of the box.

(2 marks)

II. Draw a vector diagram of the forces. Clearly label the angle and the force components as F_g (gravitational force), $F_{g\,II}$ (parallel force) and F_n (normal force).

(4 marks)

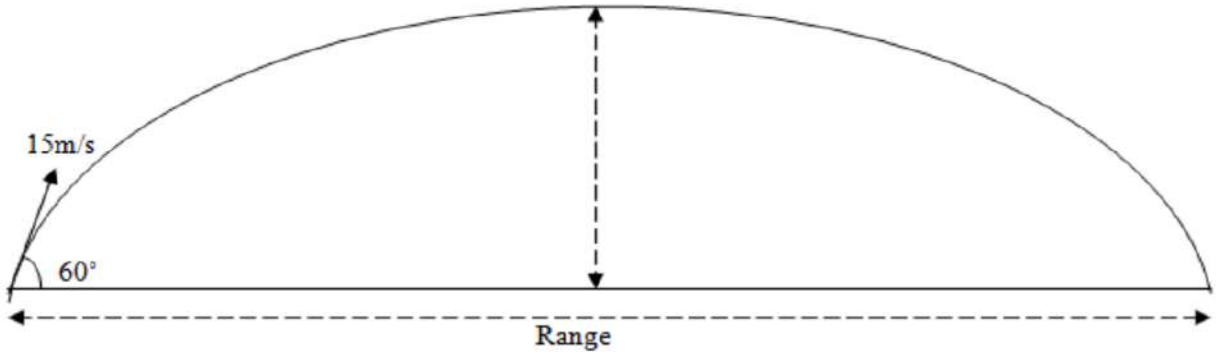
III. Calculate $F_{g\,II}$.

(2 marks)

Q5	
16	

QUESTION 6: **[16 MARKS]**

A. A projectile is launched with a speed of 15m/s at an angle of 60 with the horizontal.



I. Calculate the horizontal (V_h) and the vertical (V_v) component of velocity.

(4 marks)

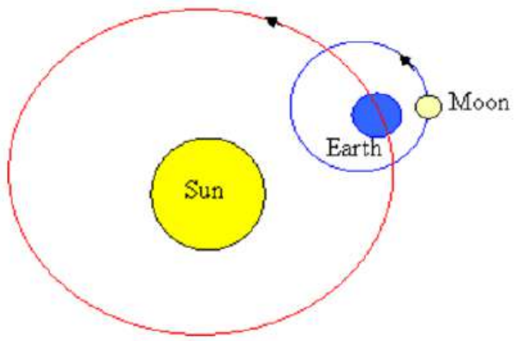
II. Calculate the maximum height reached.

(2marks)

III. What is the velocity at maximum height?

(2 marks)

B. The orbit of the Moon about the Earth is approximately circular, with a mean radius of 3.84×10^8 m. It takes 27.3 days for the Moon to complete one revolution about the Earth.



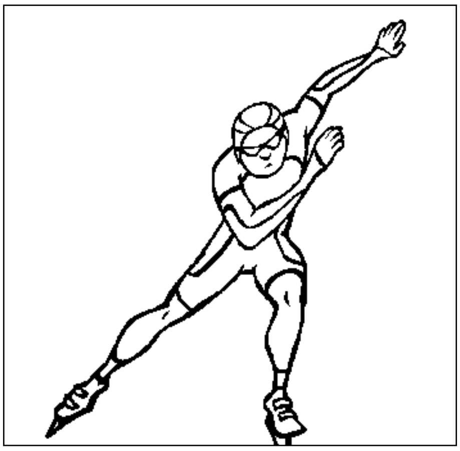
I. Calculate the mean speed of the moon.

(2 marks)

II. Calculate the centripetal acceleration of the moon.

(3 marks)

C. An 82kg speed skater negotiates a turn with a radius of 23 meters at a constant speed of 15m/s.



I. What kind of force is acting in the case above?
_________________________ force.

(1 mark)

II. Calculate the force acting on the speeding skater.

(2 marks)

Q6	
16	

QUESTION 7: **[16 MARKS]**

A. A trolley of mass 3kg moves with a speed 4m/s. It then collides head on with a stationary trolley of mass 1kg. They stick together and move off with a speed of 3m/s.

I. Calculate the kinetic energy of the 3kg trolley before collision.

(2 marks)

II. Calculate the Kinetic energy after collision.

(2 marks)

III. Show that kinetic energy is not conserved and **name** the type of collision that occurs.

_______________ collision.

(2 marks)

B. Three litres of water at 100 °C are added to 15 litres of water at 40 °C. Calculate the temperature of the mixture. Take the mass of 1 litre of water to be 1 kg and the specific heat capacity of water to be 4.2×10^{3} J kg^{-1} K^{-1}.

(3 marks)

C. A plastic bag is partially inflated by air with a volume of $200cm^3$ at 17^oC and then the sealed bag warmed to a final temperature of 57^oC without a change in Pressure.

I. Express 17°C and 57°C in Kelvin.

(2 marks)

II. Calculate the new volume of air in the plastic bag.

(2 marks)

III. In the afternoon, you went to the market and noticed that some of the dry coconuts that were exposed to the sun have cracked. Describe how pressure produces the force to do so.

____

____

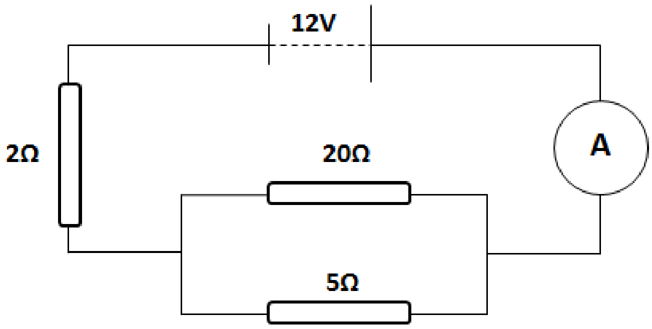
____

(2 marks)

Q7	
16	

QUESTION 8: **[16 MARKS]**

A. The diagram below is a circuit diagram. It shows resistors connected in parallel and series. Use the diagram to answer the following questions.



I. The voltage of the battery is shown to be 12V. This means that to every _____________ of charge, the battery supplies 12 _____________ of energy.

(2 marks)

II. Show by calculation that the total resistance of the circuit above is 6Ω.

(3 marks)

III. What current reading will show on the ammeter labelled A in the circuit diagram.

(2 marks)

IV. Calculate the potential difference across the 2Ω resistor.

(2 marks)

V. What is the current through the 20Ω resistor if the current through the 5Ω resistor is 1.6A?

(1 mark)

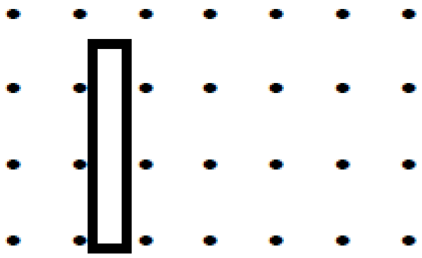
VI. The current through the 5Ω resistor is 1.6A. Calculate the power output of this resistor. Also give the correct unit of power.

(2 marks)

B. The diagram below shows a conductor moving in a uniform magnetic field. Show with arrows on the diagram the direction of

I. current in the conductor, and

II. the force on the conductor.



(2 marks)

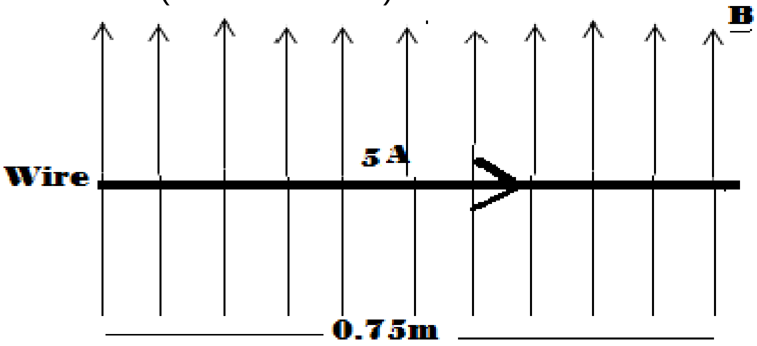
III. If the length of the conductor is 30cm and the magnetic field strength is 0.2T. Calculate the force exerted by the magnetic field on the conductor when a current of 0.1 amps flows through.

(2 marks)

Q8	
16	

QUESTIN 9: **[16 MARKS]**

A. A current of 5A flows through a horizontal wire in a magnetic field directed vertically upwards. The length of the wire is 0.75m. The wire experiences a magnetic force of 0.25N. ($k=2x10^{-7}NA^{-2}$).



I. Calculate the magnetic field strength **B.**

(2 marks)

II. Determine the direction the magnetic force acts on the wire.

_________________________________ (1 mark)

B. A power cable is slung between two towers 0.5km apart and carries a current of 5A. If the components of the earth's magnetic field at right angle to the cable is 60μT,

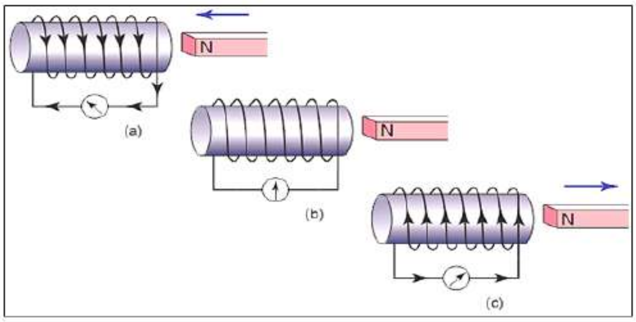
I. Calculate the total magnetic force on the cable.

(2 marks)

II. Calculate the voltage if a load of 30Ω is connected to the ends of the cables.

(2 marks)

C. Faraday discovered EM induction by taking a conducting coil connected in series with a galvanometer. He move a bar magnet in front of the coil and the result is as shown in the table below.



Action	Result
One pole moved in	Need deflects one way
Same pole moved out	Needle deflect other way
Magnet at rest	No deflection
Slower movement	Less deflection
Faster movement	More movement

I. Explain why EMF is induced in (a) and (c) as shown in the diagram above.

____
____
____

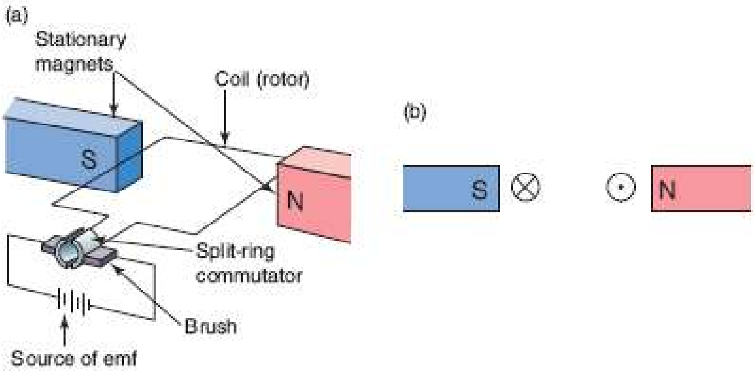
(2 marks)

II. When Faraday conducts the experiment, he found out that the strength of the induced current and the voltage can be increased by:

a. ____
b. ____
c. ____

(3 marks)

D. Part (a) of the diagram below shows a single coil rotating between two magnetic poles. The cross and dot in part (b) indicate the flow of current.



I. In part (b) of the diagram, draw the direction of force on the wire.

(2 marks)

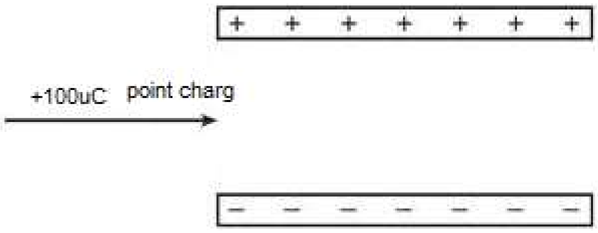
E. Calculate the magnetic field strength B from a point 10cm away from a conductor which delivers a charge of 1C in 0.15s. (Use $k = 2 \times 10^{-7}$ N/m).

(2 marks)

Q9	
16	

QUESTION 10 **[16 MARKS]**

A. A point charge of **+100μC** is fired midway between two parallel plates 10mm apart. The plates are connected to a 24V power supply.



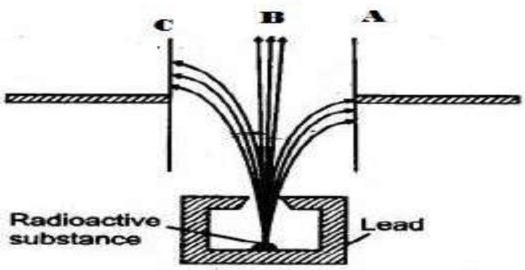
I. Draw four (4) arrows to indicate the direction of magnetic field lines in the diagram.
Also draw the path the point charge will follow in the field.

(2 marks)

II. Calculate the **electric field** strength at the negative plate. Let k =9 x $10^9 Nm^2/C^2$.

(2 marks)

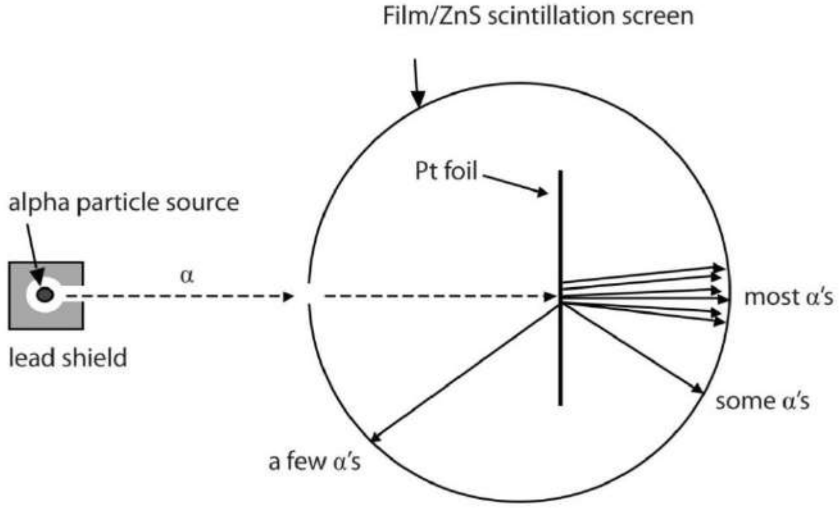
B. The diagram below shows the deflection of the radioactive particles during their emission. Name the radioactive substance according to the labels on the diagram.



A. ________________ B. __________________ C. ________________

(3 marks)

C. The diagram below shows the results of Rutherford's experiment when he fired alpha particles at a thin sheet of gold leaflet.



Explain below what causes the observed behaviour of the alpha particles as they strike the thin gold leaflet.

____
____
____

(2 marks)

D. In the boxes provided in the equation below, write the numbers that balance the equation.

$$^{233}_{\square}U \rightarrow \,^{\square}_{90}Th + \,^{4}_{2}He$$

(2 marks)

E. An 80-gram sample of $^{3}_{1}H$ decays, leaving 2.5g of $^{3}_{1}H$. How long will this take?

(2 marks)

F. Give two uses of radioactive substance.

1. ____
2. ____

(2 marks)

G. Give one disadvantage of using radioactive substances.

____

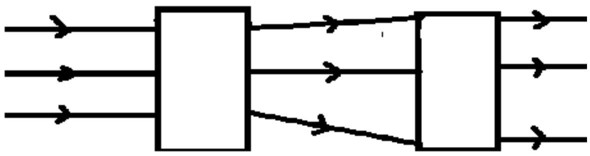
(1 mark)

Q10	
16	

SECTION B: **MULTIPLE CHOICE** **(40 MARKS)**

WRITE THE CORRECT LETTER OF YOUR ANSWER ON THE BACKFLAP OF THIS BOOKLET. THERE ARE 20 MULTIPLE CHOICE QUESTIONS WORTH 2 MARKS EACH.

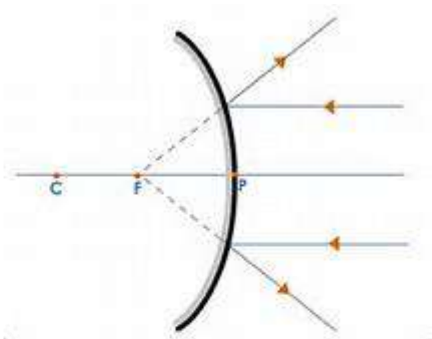
1. The diagram below falls on to the two optical components represented open boxes.



Which is the correct order from left to right?

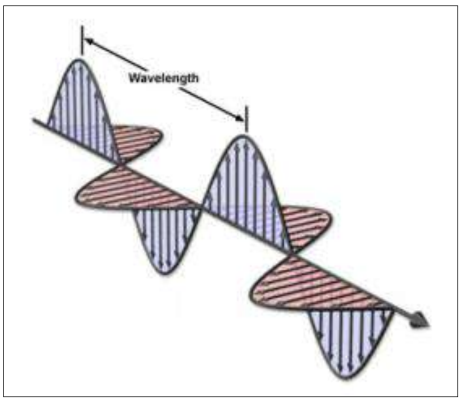
A. Convex lens, concave lens.
B. Concave lens, convex lens.
C. Convex lens, convex lens.
D. Convex lens, parallel-sided glass.

2. A convex mirror forms an image that is;



A. Upright and magnified.
B. Laterally inverted and diminish.
C. Upright and diminish.
D. Inverted and magnified

3. The wave shown below is;

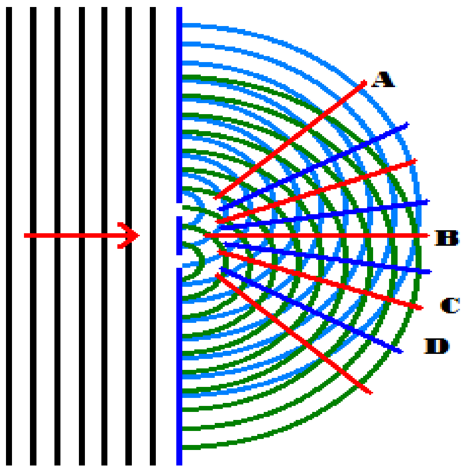


A. Transverse, with particles travel along the wave.
B. Transverse, with particles perpendicular to the direction of the wave.
C. Longitudinal, with particles moving along the wave.
D. Longitudinal, with particles perpendicular to the direction of the wave.

4. In the dispersion of white light, the most deviated light is?

   A. Red light
   B. Yellow light
   C. Blue light
   D. Violet light

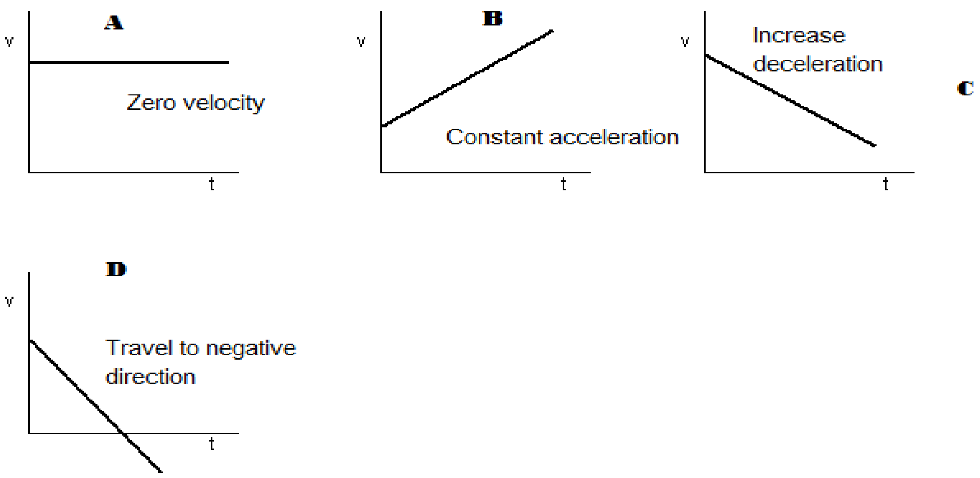
5. The diagram below shows the interference of waves.



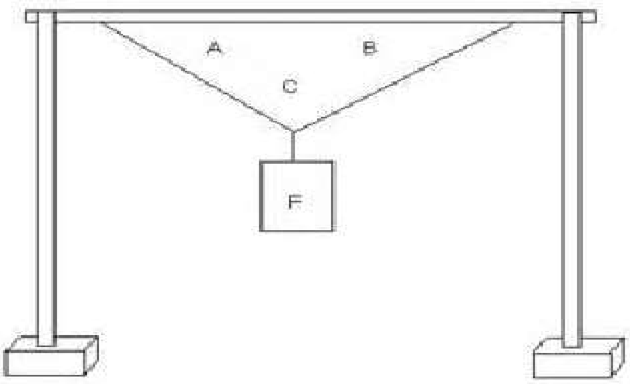
   Which statement is correct?

   A. A and Dare antinodes.
   B. B and C are nodes.
   C. A and C are antinodes.
   D. C and D are maxima.

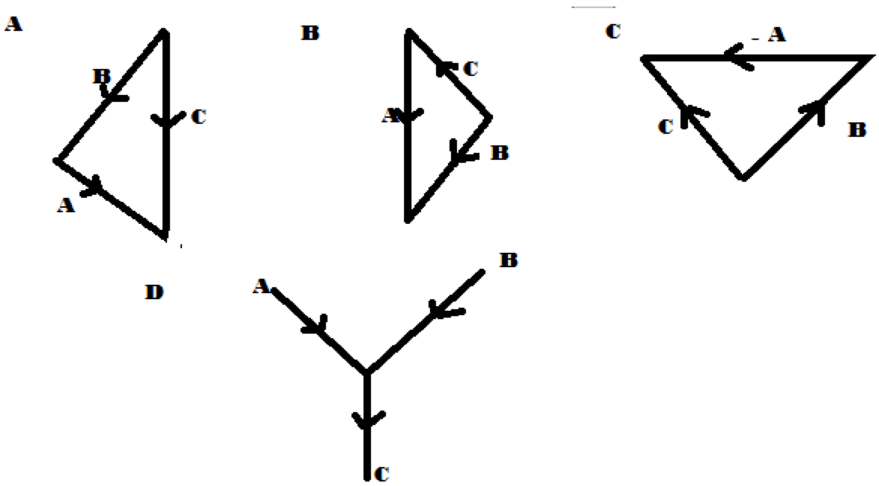
6. The graph below shows the motions of different objects. Circle the letter of the graph with correct description;



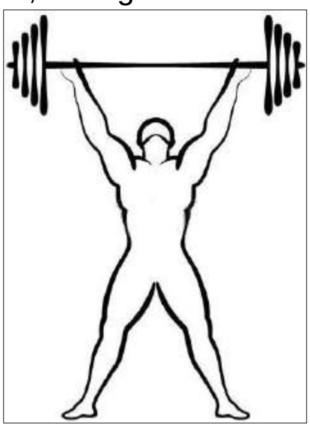
7. The diagram below shows two ropes that support a hanging object.



Which of the following correctly represent the vector addition of the force acting on the object?



8. In a weight lifting competition in 2017, Leong was able to lift a mass of 120kg.



What force did Leong need to overcome to lift the weights?

A. 1177.2kg

B. 1771.2 N

C. 1177.2N

D. 1717.2 N

9. A baseball player holds a bat loosely and bunts a ball. Express your understanding of momentum conservation by using the table below to circle the correct answer.

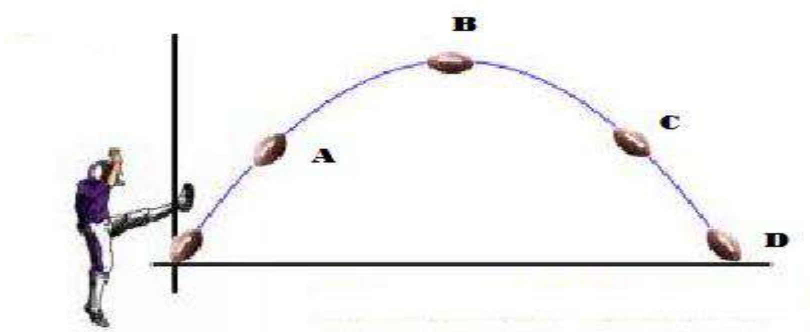
	Before collision	After collision
Bat	80	b
Ball	-40	10
Total	a	c

A. a=+80 c= +40 b= 30
B. a=+40 c= +40 b= 30
C. a=+40 c= +30 b= 40
D. a=+80 c= +40 b= 20

10. A metal box weighs 30 kg on the earth's surface was taken to the moon to review the value of gravity on the earth and moon respectively. Which statement is correct?

A. The box has a mass of 30kg on earth and 10kg on the moon.
B. The box has a weight of 30 N on the earth and 30N on the moon
C. The box has a weight of 294.3 N on the earth and 30kg on the moon
D. The box has a weight of 30 N on the moon and 294.3kg on the earth

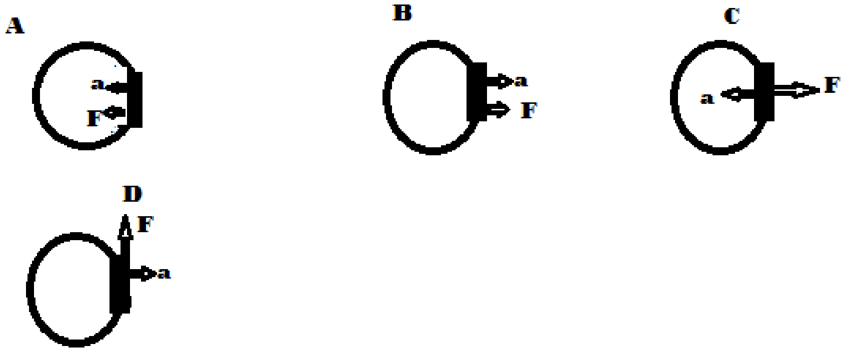
11. An American football player kicked a rugby ball as show below. Which statement is correct?



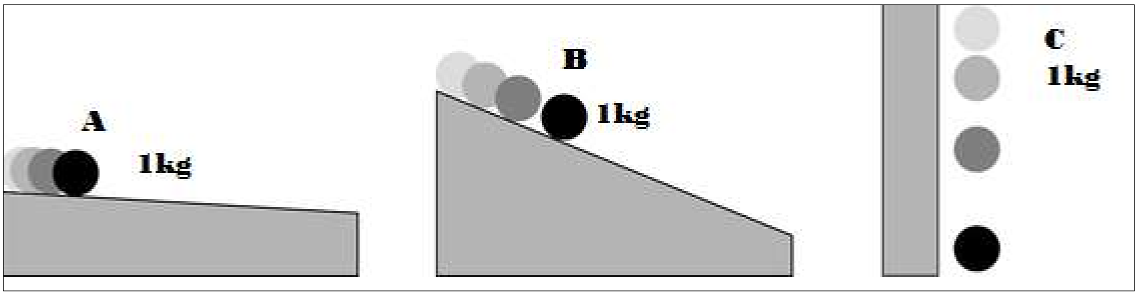
A. The ball has zero velocity at point D.
B. The ball has same vertical velocity at A and B.
C. The ball has same horizontal velocity at A, B and C.
D. The ball has zero horizontal velocity at B

12. The four images below show an aircraft viewed from above and travelling in a circular path.

Which diagram correctly shows the directions of the aircraft's acceleration and tension?



13. Three one kilogram steel ball were allowed to roll freely down three different surface as shown in the diagram below;



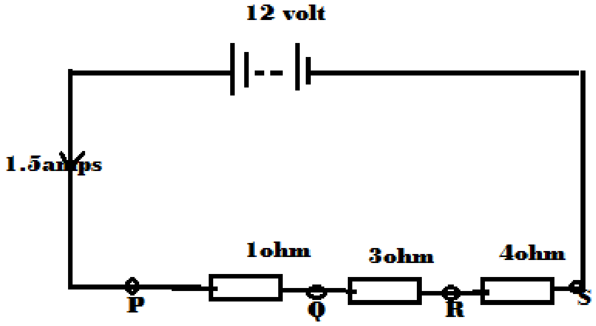
Which of the three balls will reach the ground first?

A. Ball A, because it is close to the ground
B. Ball A and Ball B will land first before Ball C
C. Ball C will land first on the ground
D. The three balls will land at the same time because of the same gravity acting on them.

14. An amount of air at atmospheric (10^5 Pa) is contained inside a bicycle pump with the nozzle sealed. The volume of the pump is $12cm^3$.
What is the pressure of air inside the pump if the handle is pulled out to a volume of $24cm^3$?

A. P_2= $5x10^5$ Pa
B. P_2= 3x10 ^{5}Pa.
C. P_2=$4.8x10^5$ Pa.
D. P_2= $12x10^5$ Pa

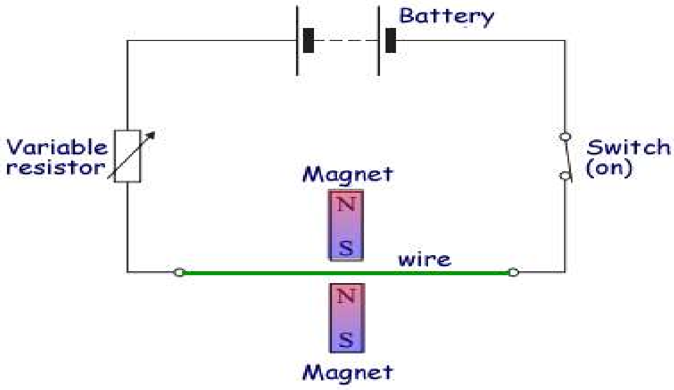
15. A 12 volt battery supplies 1.5 amperes to a circuit as shown in the diagram ;



A voltmeter will read 6 volt if connected between the two points

A. PQ
B. PR
C. RS
D. QR

16. Two bar magnets were position to allow the interaction of magnetic fields to occur between the conductor and the magnet. What will happen to the wire if the switch is closed?

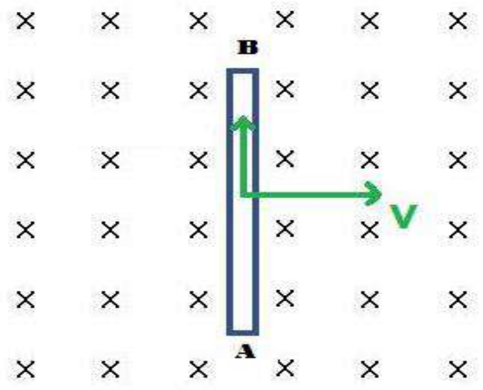


A. Deflect downwards to the north
B. Deflect upwards towards the south pole
C. Vibrating up and down between the two magnets
D. Go back and forth

17. The magnetic field 10cm from a wire carrying a current of 2A is;

A. $2x10^{6}T$
B. $2x10^{-6}T$
C. $4x10^{-6}T$
D. $8x10^{-6}T$.

18. In the diagram below, the direction of the magnetic field and velocity of the rod are shown,



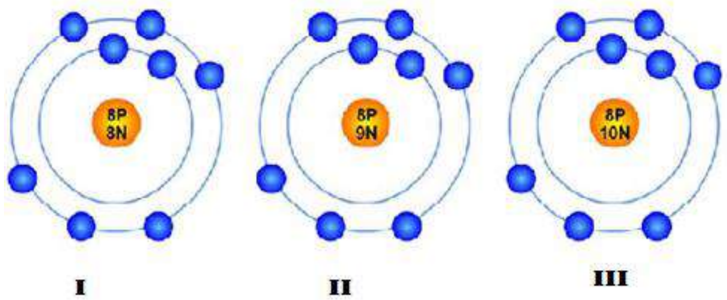
Which statement is true?

A. Protons will be moving towards A and electrons will be moving towards A
B. Protons will be moving towards B and electrons will be moving towards A
C. Both ends will be neutral
D. Both electron and proton move to the centre of the rod.

19. A +1mC charge and a -2mC charge are separated by 0.5m. The force between them is

A. -72 Nx10 N and attractive
B. $-7.2\text{x}10^{-2}$ N and repulsive
C. $-72\text{x}10^{-4}$N and attractive
D. $-7.2\text{x}10^{-3}$N and repulsive

20. The diagram below shows three different forms of atomic structures. Which statement is correct



A. All atoms of Oxygen
B. II and III are oxygen ion and I is an oxygen atom
C. I, II and III are Isotopes of Oxygen
D. I is Oxygen atom, II is Fluorine atom and III is Neon atom

SECTION B
MULTIPLE CHOICE (40 MARKS)

Write clearly the letter of the correct answer in the box provided. Make sure your answer is put alongside the right question number.

EXAMPLE:
If you consider B is the correct answer, write it like this: B
To change your answer from B to C, cross out B and write the new answer by the box, like this: ~~B~~ C

1.		**11.**	
2.		**12.**	
3.		**13.**	
4.		**14.**	
5.		**15.**	
6.		**16.**	
7.		**17.**	
8.		**18.**	
9.		**19.**	
10.		**20.**	

Number correct ☐ **X 2 =** ☐ / **40**

Student Personal Identification Number

PHYSICS 2017

FOR MARKER USE ONLY		
QUESTION	**M A R K S**	**Score**
Section B	**40**	
A Q.1	**16**	
A Q.2	**16**	
A Q.3	**16**	
A Q.4	**16**	
A Q.5	**16**	
A Q.6	**16**	
A Q.7	**16**	
A Q.8	**16**	
A Q.9	**16**	
AQ.10	**16**	
TOTAL	**200**	

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