2017-18 MOCK
F.6 PHY
PAPER 1B

B

TWGHs Wong Fut Nam College
Mock Examination 2017-18

PHYSICS PAPER 1
Section B: Question-Answer Book B

8:30 am – 11:00 am (2 hours 30 minutes)
31 Jan 2018 (Wed)

This paper must be answered in English

Setter: Leung Shu Kei

INSTRUCTIONS FOR SECTION B

(1) After the announcement of the start of the examination, you should first write down the information required in the spaces provided on the cover.

(2) Refer to the general instructions on the cover of the Question Paper for Section A.

(3) Answer **ALL** questions.

(4) Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(5) Graph paper and supplementary answer sheets will be provided on request. Write your class number and mark the question number box on each sheet, and fasten them with string **INSIDE** this Question-Answer Book.

(6) No extra time will be given to candidates for filling in the question number boxes after the 'Time is up' announcement.

Student Name				
Class No.	6			

Question No.	Marks	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
Script Total		

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Section B: Answer ALL questions. Parts marked with "*" involve knowledge of the extension component. Write your answers in the spaces provided.

Question No.	1	2	3	4	5	6	7	8	9	10	11	Total
Marks	5	6	11	10	6	9	9	7	10	5	6	**84**

1. Molecular gastronomy (分子料理) is a new way of preparing food used by modern chef.

Figure 1.1

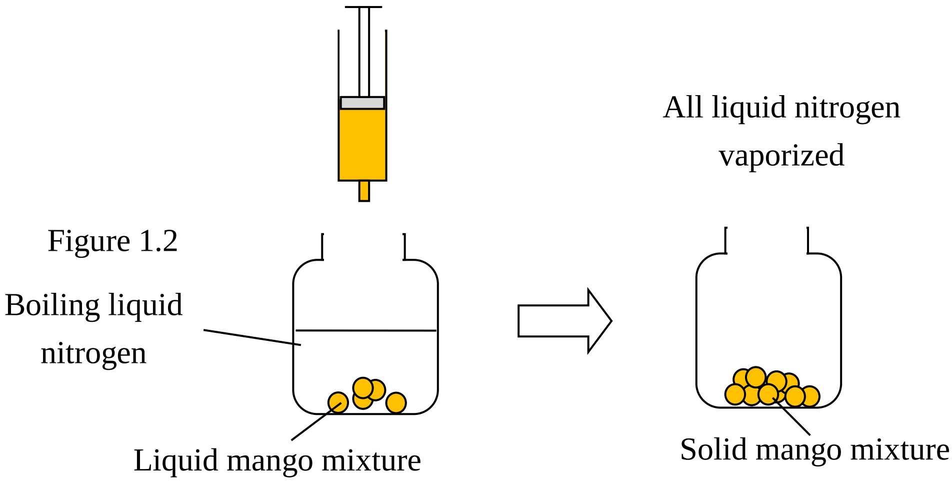
Annie wants to prepare a mango dessert by the following method: (As shown in Figure 1.2.)

Firstly, mango is blended with water to become mango mixture and is stored in a syringe.

Then, 0.1 kg of the mango mixture at 15 °C is added into a jar of 0.2 kg of boiling liquid nitrogen.

Finally, solid mango balls are formed after ALL the nitrogen vaporized.

Figure 1.2



Given that: The specific heat capacity of mango mixture in liquid state is 4000 J kg^{-1} °C^{-1}

The specific heat capacity of mango mixture in solid state is 3000 J kg^{-1} °C^{-1}

The latent heat of vaporization of nitrogen is 1.98×10^5 J kg^{-1}

The latent heat of fusion of mango mixture is 3.12×10^5 J kg^{-1}

(a) (i) Find the amount of heat absorbed by the liquid nitrogen when all of them vaporized. (1 mark)

……

……

……

(ii) After all the 0.2 kg of liquid nitrogen is vaporized and goes away, all the 0.1 kg of liquid mango mixture turns into solid. Find the final temperature ***T*** of the solid mango balls formed.

Given that the melting point of the mango mixture is –2 °C

the boiling point of nitrogen is –196 °C (2 marks)

……

……

……

……

……

……

*(b) During the preparation, it is very dangerous to cover and seal the jar with a lid as the gas pressure inside the jar will increase very quickly. By using the kinetic theory of gas, explain briefly why the gas pressure in the sealed jar increases when the liquid nitrogen vaporizes. (2 marks)

……

……

……

……

……

……

2. You are given the apparatuses as shown in Figure 2

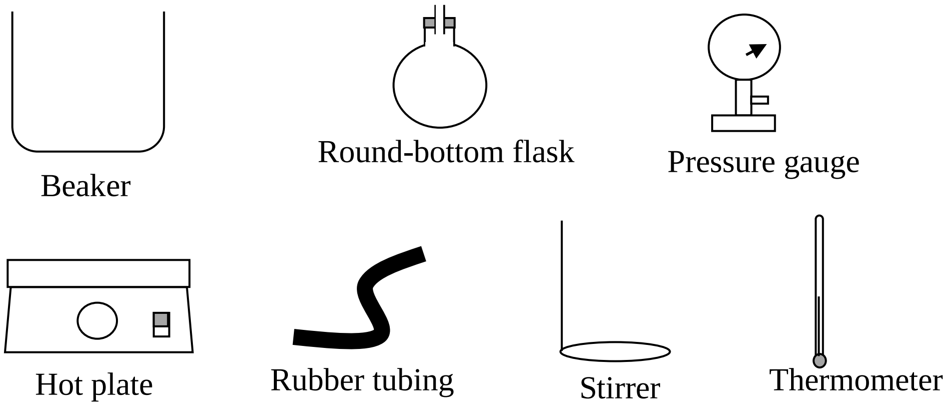


Figure 2

(a) With the aid of a diagram, describe an experiment to investigate the relationship between the gas pressure ***P*** and the temperature ***T***. Furthermore, you also describe the results of the experiment and the method of finding the value of absolute zero from this experiment. (6 marks)

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

3. Figure 3.1 shows a crane tower used in a construction site. *QR* is a horizontal beam of length 30 m. It has a weight of 30000 N with its centre of gravity at *O*. It is hinged and is free to rotate about point *R* on the tower. A cable *MN* is used to connect the beam to the tower to prevent it from falling. A block of mass 400 kg is hung by a vertical cable *PQ*. At the beginning, the block is at rest at position A.

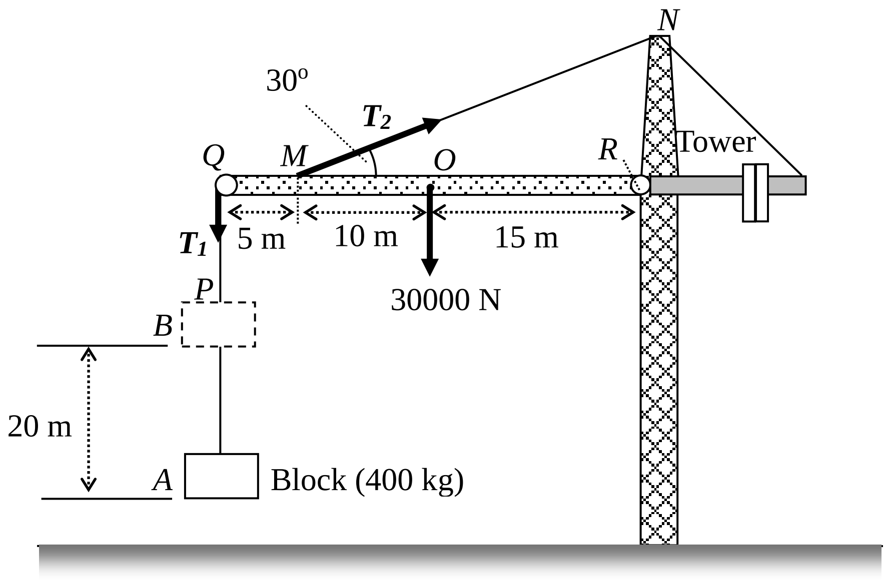


Figure 3.1

(a) Find the tension T_2 in cable *MN* in order to keep the beam at equilibrium. (2 marks)

………

………

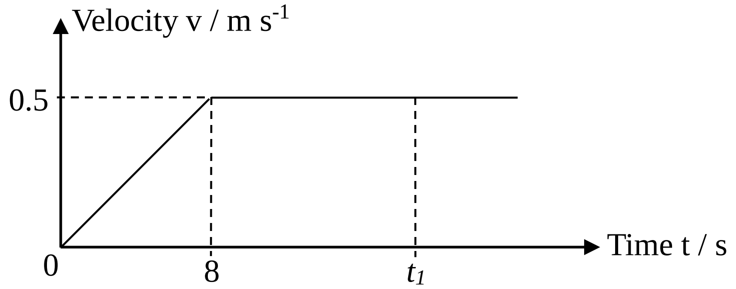
………

………

The block is now pulled up vertically by the cable *PQ* to position B which is 20 m above position A.

The velocity – time (v – t) graph of the motion of the block is shown in Figure 3.2 below.

Figure 3.2



Answers written in the margins will not be marked.

Answer written in this margins will not be marked.

(b) (i) Find the distance moved by the block in the first 8 s.

(ii) Hence, find the time t_1 for the block to reach point B. (3 marks)

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

(c) (i) Find acceleration of the block at t = 4 s.

(ii) Hence, find the new tension $\boldsymbol{T_1'}$ in the cable *PQ* at this moment. (4 marks)

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

(d) Find the average power output to lift the block during **the period t = 0 to 8 s**. (2 marks)

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

4. In a foggy day, a car of mass 2000 kg is moving with a constant speed of 25 m s^{-1} on a straight road. Suddenly, the driver notices a van of mass 8000 kg ahead of him which is moving in the same direction with a speed of 4 m s^{-1}. The driver of the car hits the brake at once but the car still crashes into the van from behind after 2s. The speed of the car just before the collision is 20 m s^{-1} as shown in Figure 4.1.

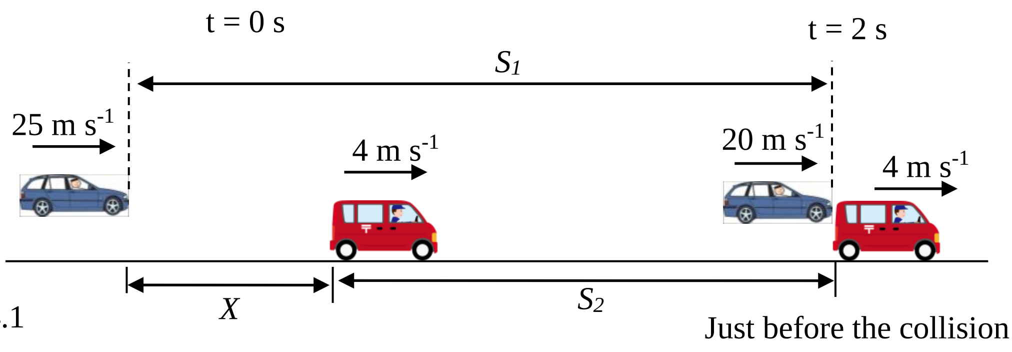


Figure 4.1

(a) Find the distance X between the car and the van at t = 0 s when the driver see the van. Neglect the size of the car and the van in the calculations. (3 marks)

....

....

....

....

....

....

....

(b) After the collision, the van moves with a greater speed of 10 m s^{-1} in the original direction as shown in Figure 4.2.

Figure 4.2

Answers written in the margins will not be marked.

(i) Find the **magnitude** and **direction** of the velocity of the car just after the collision. (3 marks)

………

………

………

………

………

………

(ii) The impact time is 0.4 s. Find the force of impact **on the car**. (2 marks)

………

………

………

………

………

(iii) Explain briefly how the **air bag** in the car protects the driver during the collision. (2 marks)

………

………

………

………

………

………

………

Answers written in the margins will not be marked.

5. A water slide in a theme park is shown in Figure 5.1.

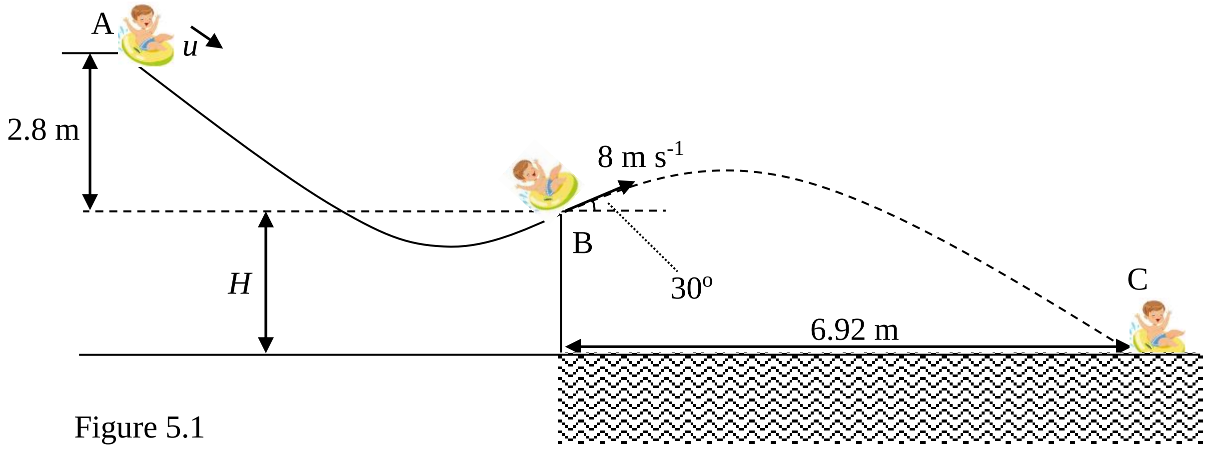


Figure 5.1

(a) Henry slides down from point A with an initial speed u and flies off the slide at point B with a speed of 8 m s^{-1}. Point A is 2.8 m above point B. Find the speed u. (2 marks)

....

....

....

....

....

....

....

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

*(b) After Henry flies off from point B, he lands on the water surface at point C which is 6.92 m away.

(i) Find the time of the flight in air before Henry lands on the water surface. (2 marks)

....

....

....

....

....

....

....

(ii) Find the height *H*. (2 marks)

....

....

....

....

....

....

....

....

Answers written in the margins will not be marked.

6. (a) Figure 6.1 shows a transverse travelling wave pulse propagating along a long elastic cord. At this moment, particle *P* is moving downwards.

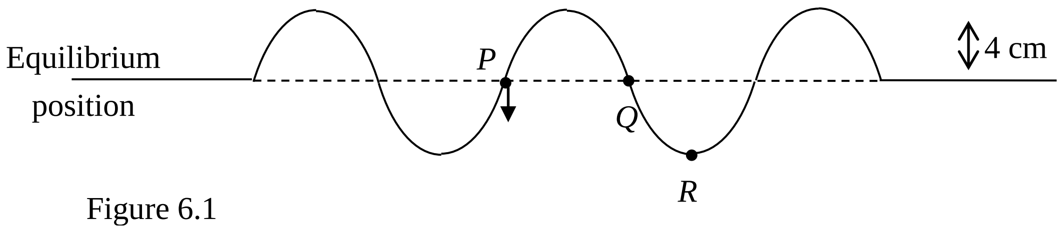


Figure 6.1

(i) What is the direction of travel of the wave? (1 mark)

……………………………………………………………………………………………………….

(ii) Describe the motion of particles *Q* and *R* at this moment. (2 marks)

Q: …………………………………………………………………………………………….

R: …………………………………………………………………………………………….

(iii) The displacement – time graph of the motion of particle *R* is shown in Figure 6.2.

Sketch on Figure 6.3 to show the motion of particle *Q*. (2 marks)

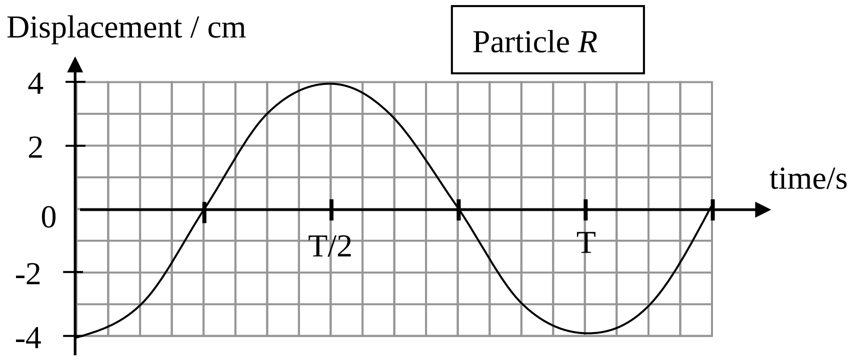


Figure 6.2

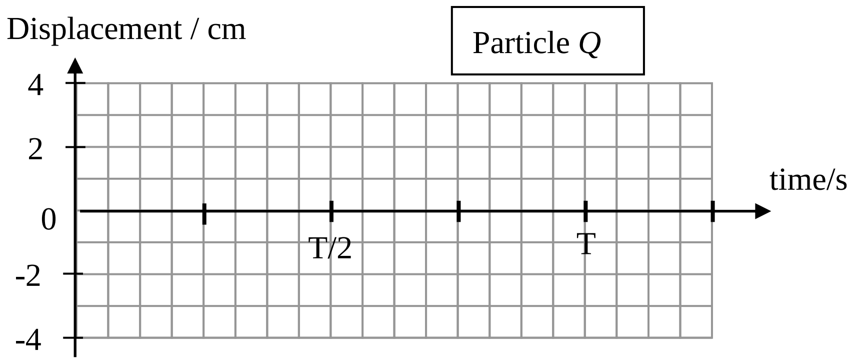


Figure 6.3

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

(b) Now a transverse stationary wave is set up on the elastic cord by a vibrator as shown in Figure 6.4.

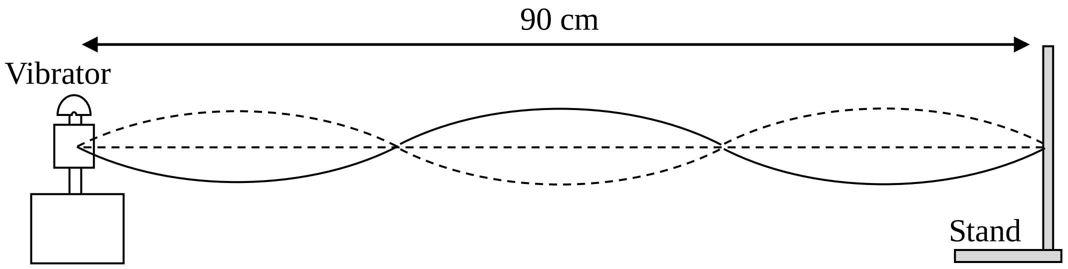


Figure 6.4

(i) The frequency of the vibrator is f = 6 Hz.

Find the speed of the wave travelling along the elastic cord. (2 marks)

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

*(ii) Explain with suitable calculations, show that it is NOT possible to produce a stationary wave on the elastic cord by just adjusting the frequency of the vibrator f to 9 Hz alone. (Assume that the wave speed and the length of the elastic cord is kept constant throughout the process.) (2 marks)

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Answers written in the margins will not be marked.

7. In Figure 7.1, *XY* is the principal axis of a thin spherical lens *L*. *C* is its optical centre while *F* and *F'* are its foci. *A*, *B* and *R* are three parallel rays coming from a ***point*** *P* of a distant object (**NOT** shown).

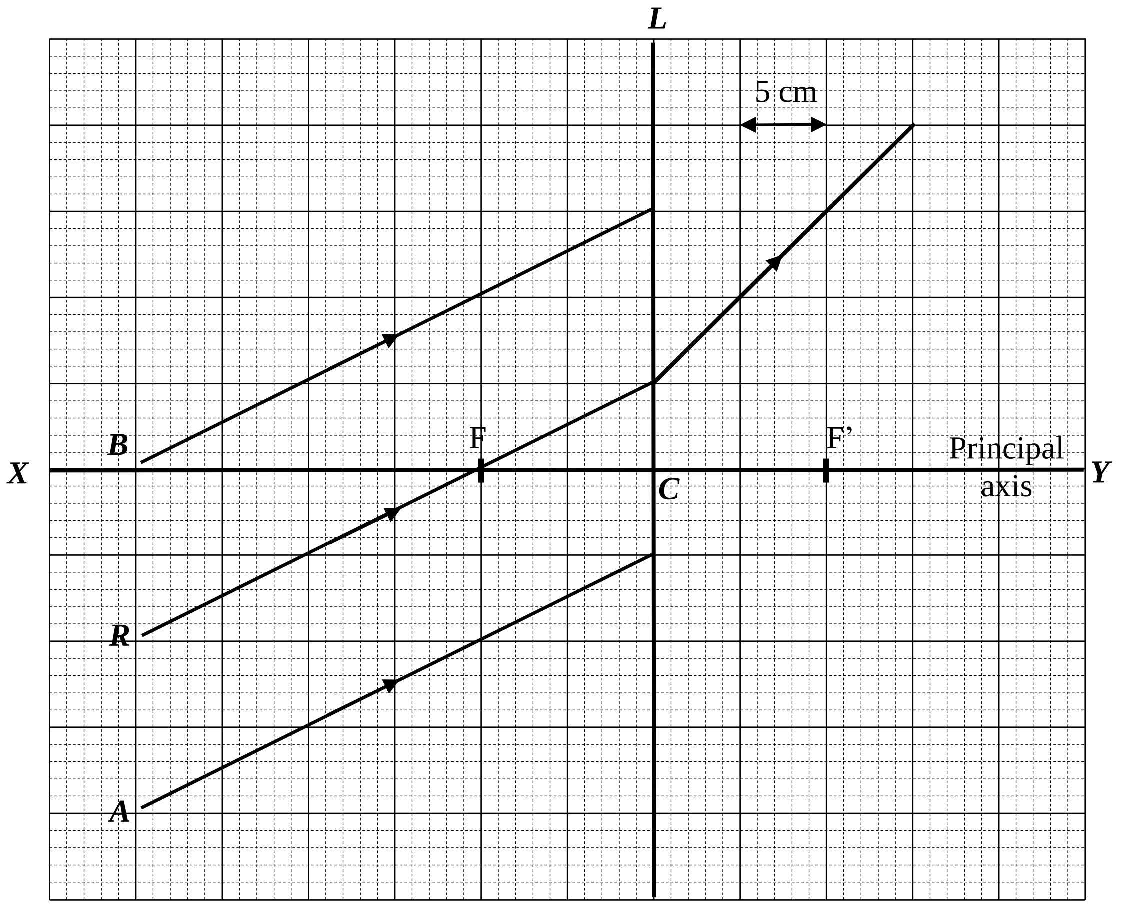


Figure 7.1

(a) (i) Explain briefly why lens *L* is a **<u>concave lens</u>** by considering the refraction of ray *R*. (1 mark)

……

……

……

(ii) State TWO natures of the image formed by lens *L*. (2 marks)

……

……

……

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answer written in this margins will not be marked.

(b) (i) Draw on Figure 7.1 to shows how the ray *A* is refracted. (1 mark)

(ii) Hence, locate the image of *P* (denoted it as point P'). (2 marks)

(iii) Draw on Figure 7.1 to shows how the ray *B* is refracted. (1 mark)

*(c) The lens is now used to view an object at a distance of u = 10 cm away.

Find the distance between the lens and the image $\boldsymbol{v}$. (Hint: you may apply the lens formula)

(2 marks)

……

……

……

……

……

……

……

……

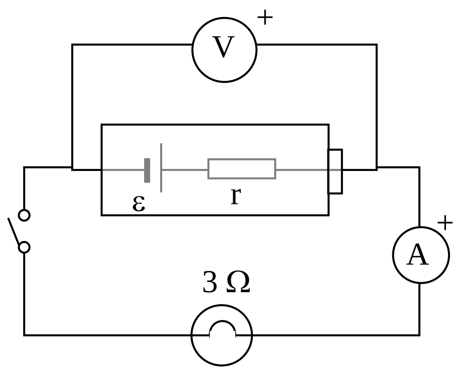
……

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

8. Max carries out an experiment to measure the e.m.f. (ε) and the internal resistance (r) of a dry cell as shown in Figure 8.1

Figure 8.1



(a) Max claims that the voltmeter and ammeter used in this experiment are ideal.

What are an ideal voltmeter and an ideal ammeter? (2 marks)

………

………

………

………

*(b) When the switch is open, the voltmeter measured a value of 3.8 V. When the switch is closed, the voltmeter and the ammeter recorded readings of 2.28 V and 0.76 A respectively.

What are the e.m.f. (ε) and the internal resistance (r) of the dry cell? (3 Marks)

………

………

………

………

………

………

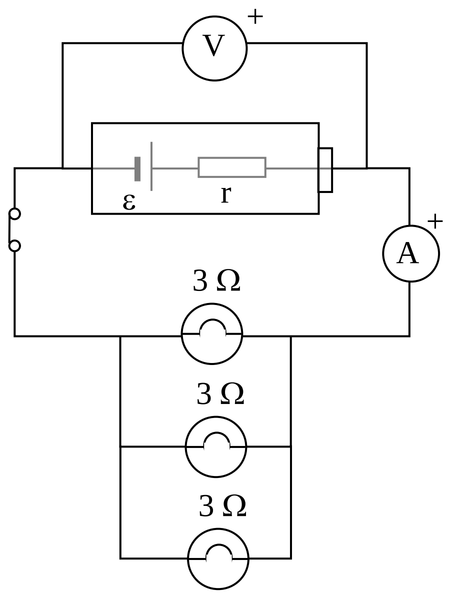
Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answer written in this margins will not be marked.

*(c) Max adds two more identical lamp bulbs in parallel to the circuit as shown in Figure 8.2.

Figure 8.2



Describe, with explanations, how do the readings of the ammeter and voltmeter change?

(2 marks)

....

....

....

....

....

....

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

9. ***You may neglect the effect of gravitational force on the electrons in this question.***

A beam of electrons pass through a region of uniform electric field which is set up by a pair of parallel plate *P* and *Q* connected to an EHT supply. The electron beam is deflected as shown in Figure 9.1 below. Given the electric field strength in the region between the plates is $\boldsymbol{E} = 2.4 \times 10^4$ N C^{-1} and the separation between the two plates is 12 cm. Assume all the electrons process the same amount of kinetic energy.

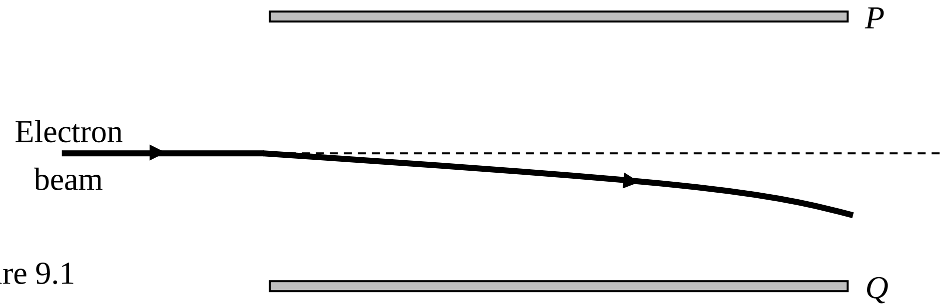


Figure 9.1

(a) (i) Find the potential difference between the parallel plate (2 marks)

……

……

……

……

(ii) Which plates, *P* or *Q*, is at a higher potential? (1 mark)

……

(b) In order to balance the electric force acting on the electron and keep the electron beam to move along its original path, a uniform magnetic field $\boldsymbol{B}$ = 0.016 T is apply in this region.

(i) What should be the direction of the magnetic field *B* be applied to keep the electron beam to move along its original path? (1 mark)

……

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

*(ii) By considering the magnetic force and the electric force acting on an electron, find the speed of the electrons. (2 marks)

………

………

………

………

*(c) The electric field is then removed suddenly.

(i) Draw in Figure 9.2 below to show the new path of the electron beam. (1 mark)

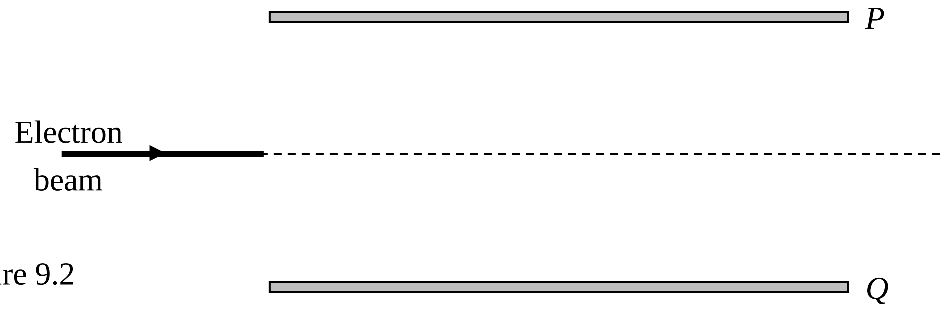


Figure 9.2

(ii) Find the radius r of the path of the electron beam if the ratio of the charge of electron to the mass of electron $q/m = 1.76\times10^{11}$ C kg^{-1}.

(3 marks)

………

………

………

………

………

………

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

10. A glider is flying at the edge of the atmosphere to study the earth magnetic field at high attitude.

Figure 10.1

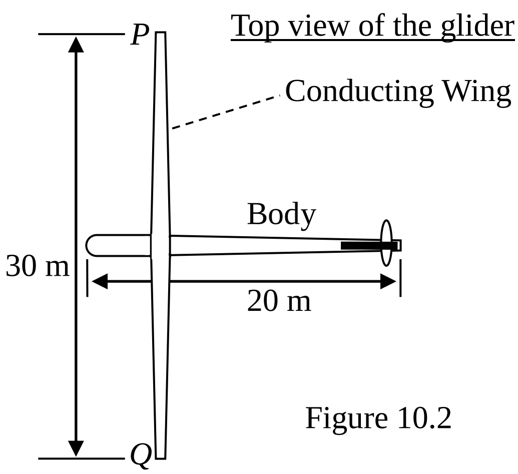


Figure 10.2

Two voltage sensors P and Q are mounted at the two ends of its wing, which is made of conducting material, as shown in Figure 10.1 and 10.2. The wingspan and the body length of the glider are 30 m and 20 m respectively.

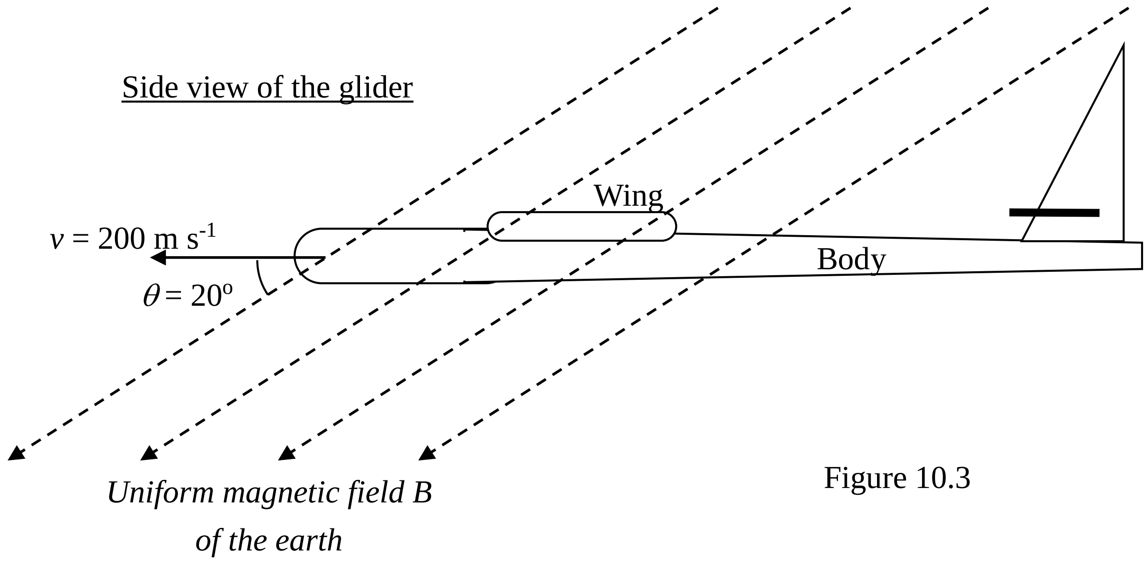


Figure 10.3

The glider is now flying horizontally with a constant velocity of 200 m s^{-1} at an angle of 20^{o} with the direction of the earth magnetic field B as shown in Figure 10.3. (Assume that the earth magnetic field at that place is uniform.)

(a) (i) Which voltage sensors, P or Q, detect a higher potential? (1 mark)

……………………………………………………………………………………………………….

Answers written in the margins will not be marked.
Answers written in the margins will not be marked.

(ii) Estimate the strength of the earth magnetic field B at that place if the potential difference between P and Q are measured to be 80 mV. (2 marks)

……

……

……

……

*(b) Someone suggested that if a rectangular metal frame *PQRS* is mounted on the glider as shown in Figure 10.4, there will be an induced current flows in the metal frame in this experiment.

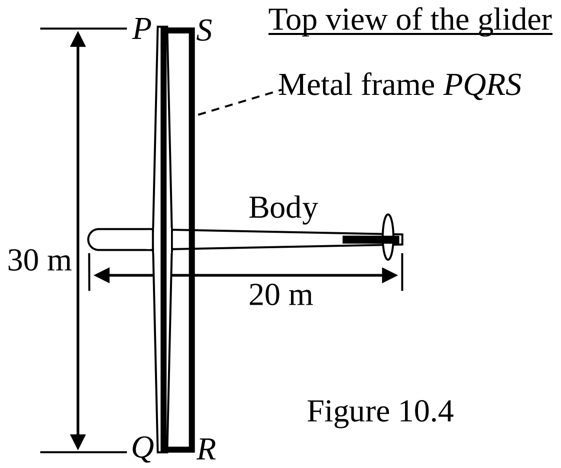


Figure 10.4

However, it is found that no induced current flows in the frame metal. Explain this observation by using the Faraday's law of electromagnetic induction and the concept of magnetic flux. (2 marks)

……

……

……

……

……

……

……

11. The decay curve in Figure 11.1 shows the variation of activity ***A*** of a radioactive isotope sodium-24 ($^{24}_{11}Na$) with time ***t***.

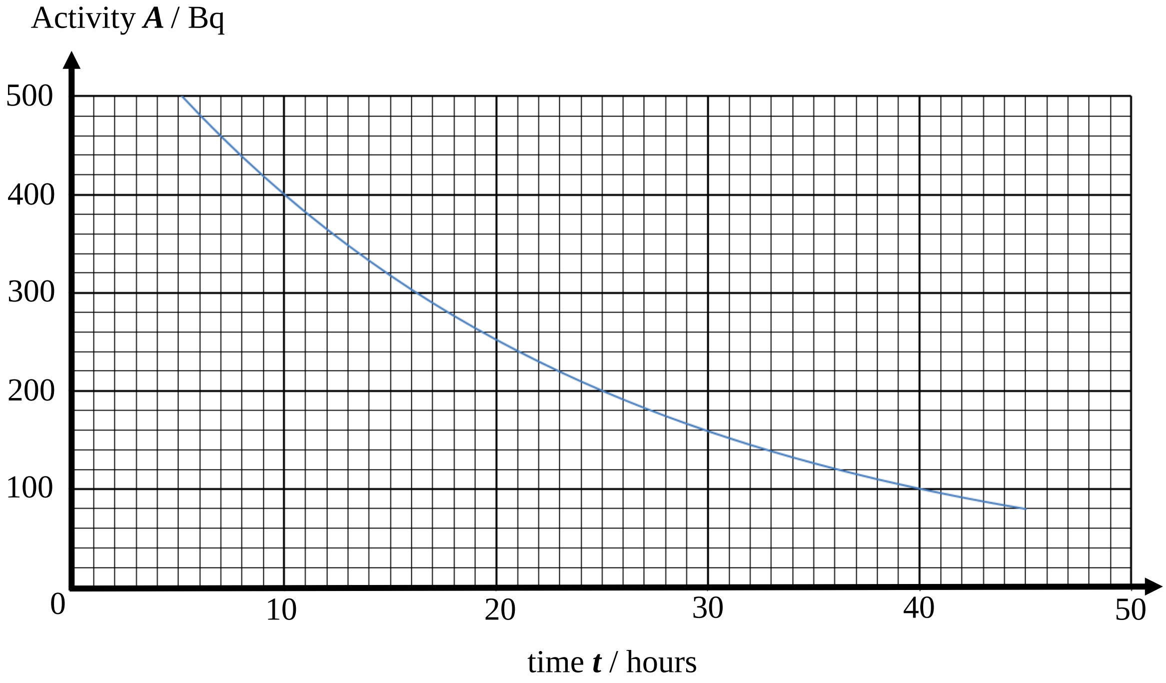


Figure 11.1

(a) (i) Find the half-life of sodium-24 from Figure 11.1. (1 mark)

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

*(ii) Hence find the decay constant ***k***, in s^{-1}, of sodium-24. (2 marks)

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answer written in this margins will not be marked.

*(iii) A sample of sodium-24 has an activity of 600 Bq. Estimate the number of sodium-24 atom in the sample. (1 mark)

………

………

………

………

(b) (i) Sodium-24 will undergoes an one step decay process to become Magnesium-24 ($^{24}_{12}Mg$). Write down the decay equation for the decay of sodium-24. (1 mark)

………

(ii) Potassium-40 ($^{40}_{19}K$) is another radioactive isotope that will be decay into Calcium-40 ($^{40}_{20}Ca$) with a decay constant of 1.76×10^{-17} s.

State a reason why Sodium-24 is more suitable to be used as tracer to test for leaks in oil pipe lines buried underground than Potassium-40. (1 mark)

………

………

………

………

………

END OF PAPER

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Do not write on this page.

Answer written on this page will not be marked.

Answers written in the margins will not be marked.