Additional Assessment Materials Summer 2021

Pearson Edexcel GCSE in Physics (1PH0) Higher

Resource Set Topic G: Static electricity, Electromagnetic induction (Separate Physics only)

Questions

(Public release version)

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Additional Assessment Materials, Summer 2021

General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

4 (a) A student rubs a plastic comb with a dry cloth to give the comb a positive electric charge.

Figure 6 shows the charged plastic comb picking up small pieces of paper.

(Source © GIPhotoStock/SCIENCE PHOTO LIBRARY)

Figure 6

(i) Explain how rubbing the comb with a dry cloth gives the comb a positive electric charge.

(3)

Friction between the cloth and the comb during rubbing causes the negatively charged electrons in the comb to move to the dry cloth. Since the comb has excess positive charge, the overall charge becomes positive.

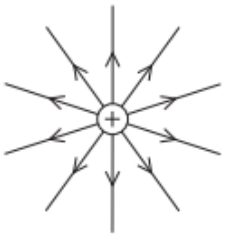
(ii) Explain how the positively-charged plastic comb picks up the small pieces of paper.

(3)

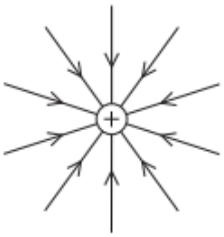
The comb causes separation of charge in the paper. The part of the paper pieces with negative charge is attracted to the comb. The attractive force is larger than the weight of the paper.

(b) Which of these diagrams shows the shape and direction of the electric field around a positive point charge?

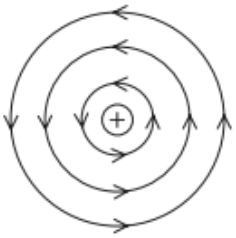
(1)



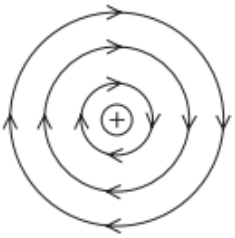
☒ A



☐ B



☐ C



☐ D

(c) Figure 7 shows two metal spheres.

Metal sphere A is fixed to a table.
Metal sphere B can be moved.

Metal sphere B is placed at a short distance from metal sphere A.

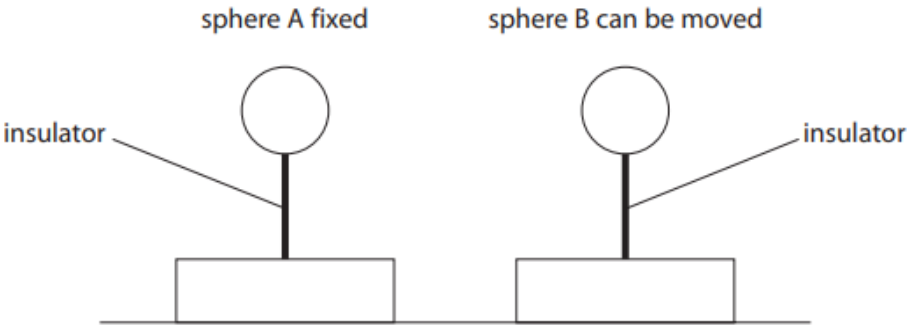


Figure 7

Both spheres are insulated from the table and given a negative charge.

The force between the charged spheres is measured.

(i) Explain, in terms of electric fields, why a force is exerted on sphere B.

(2)

The negative charges in the sphere A exert a repulsive force on the negative charges in sphere B.

(ii) Sphere B is moved and the force between the spheres is measured at several different distances.

Figure 8 is a graph of force on sphere B against distance between the centres of the spheres.

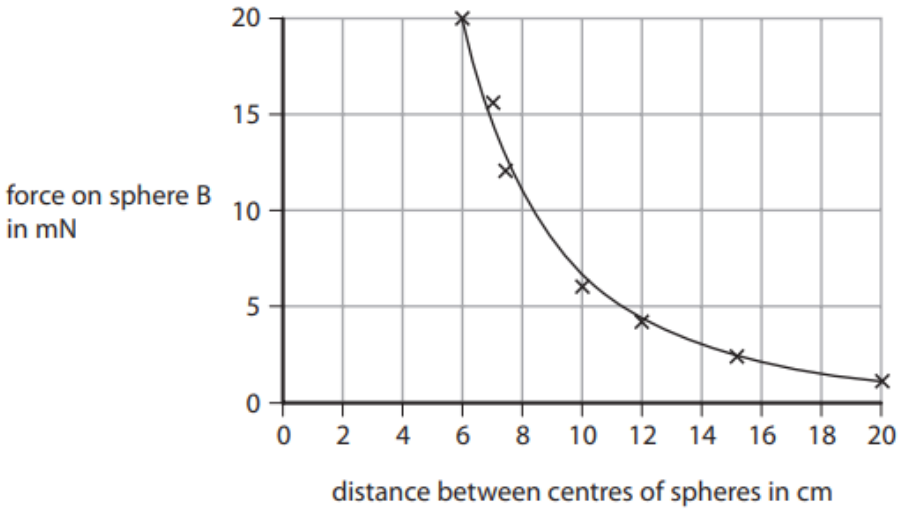


Figure 8

Describe how the force on sphere B varies with the distance between the centres of the spheres.

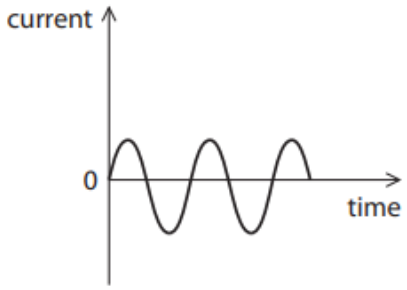
(2)

The force is maximum at 20mN when the two spheres are in contact.

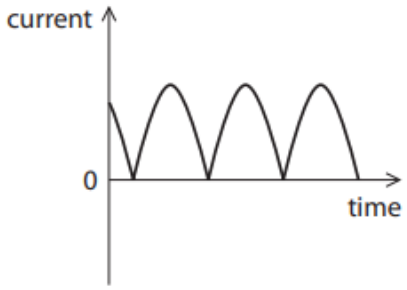
The force decreases with decreasing gradient as the distance between the two centres increase.

9 (a) Which of these could be the output for a dynamo?

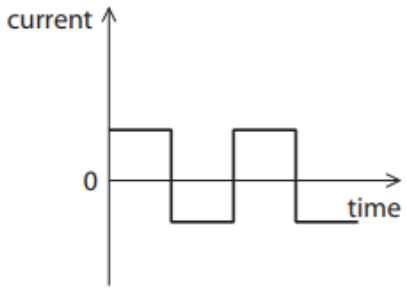
(1)



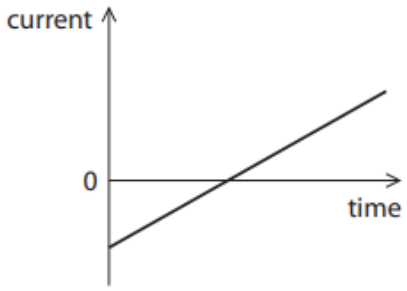
☐ **A**



☒ **B**



☐ **C**



☐ **D**

(b) (i) Figure 17 shows the output from a battery.

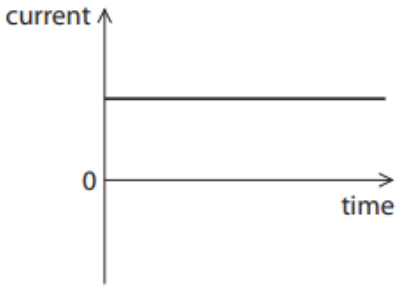


Figure 17

Explain why a transformer will not work with the input current as shown in Figure 17.

(2)

Transformers rely on a varying magnetic field to induce a current on the secondary coil, which requires an alternating current. However, the current in figure 17 is not alternating.

(ii) A transformer has 30 turns on the primary coil and 150 turns on the secondary coil.

A potential difference of 25 V is applied across the primary coil.

Calculate the potential difference across the secondary coil.

Use an equation selected from the list of equations at the end of this paper.

(3)

$$\frac{V_P}{V_S} = \frac{N_P}{N_S}$$

$$\frac{25}{V_S} = \frac{30}{150}$$

$$V_S = \frac{25 \times 150}{30} = 125$$

potential difference = 125 V

*(c) High voltage transmission cables and transformers are used in the national grid.

Explain how using high voltage transmission cables and transformers allows the distribution of electrical power around the United Kingdom to be as efficient as possible.

Refer to the following equations in your answer.

$$P = I^2 \times R$$

$$V_p \times I_p = V_s \times I_s$$

(6)

Step-up transformers are used near power stations to increase the voltage for transmission in cables. Increasing the voltage decreases the current as seen in the second equation. A lower current means a lower power loss in the cable as means of heat due to the resistance in the cable. This increases the useful power output and the efficiency as efficiency is the ratio of useful power output over total power input. A step-down transformer is used near

neighborhoods to lower the high incoming voltage from the cables and transmitted to consumer homes.

1 (a) Figure 1 shows a paint sprayer.

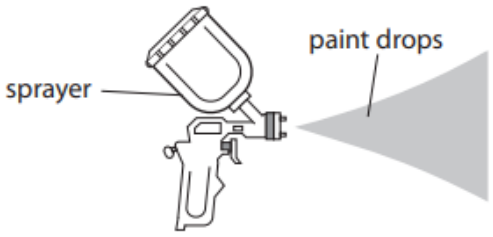


Figure 1

Some paint sprayers give the paint drops a positive charge as they leave the sprayer.

(i) The paint drops have a positive charge because the sprayer

(1)

☒ **A** removes electrons from the paint drops

☐ **B** adds electrons to the paint drops

☐ **C** removes protons from the paint drops

☐ **D** adds protons to the paint drops

(ii) Figure 2 shows the spray pattern from two different paint sprayers.

Figure 2

Sprayer X does not charge the paint drops. Sprayer Y gives the paint drops a positive charge.

Explain how charging the paint drops changes the shape of the spray pattern.

(2)

The like charges of the paint droplets repel each other giving a wider spray.

(iii) Sprayer Y is used in a factory to paint a metal object.

The object hangs by a metal wire that is connected to earth.

Explain why a metal wire is used to connect the object to earth.

(2)

The metallic object is earthed to prevent the object accumulating a positive charge due to all of the paint droplet charges. The object can conduct electrons from the earth to neutralise the charge.

(b) Figure 3 shows two charged metal plates.

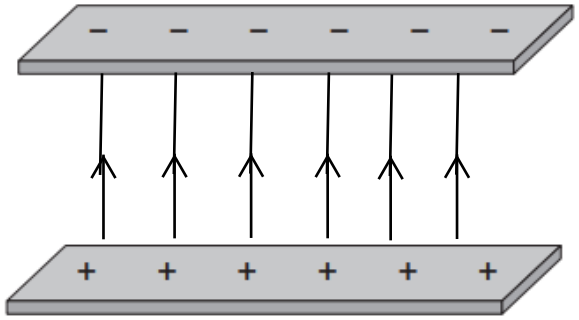


Figure 3

The top plate has a negative electric charge.

The bottom plate has a positive electric charge.

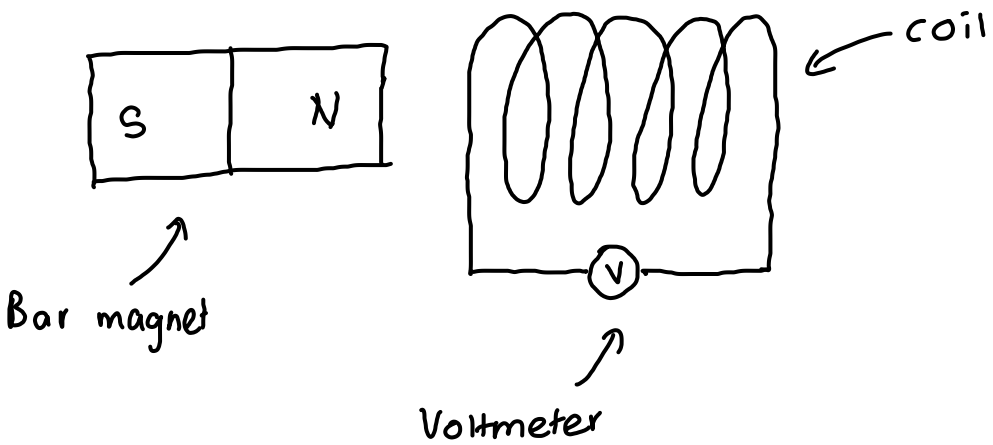
On Figure 3, draw the electric field lines between the two plates and show the direction of this electric field.

(2)

6 (a) A teacher is demonstrating electromagnetic induction.
The teacher has a bar magnet, a coil of wire and a sensitive voltmeter.

(i) Draw a diagram to show how the teacher should arrange the apparatus.

(1)



(ii) Explain how the teacher could use this apparatus to demonstrate the factors affecting the size and direction of the induced potential difference.

(4)

Move magnet towards the coil , where the voltmeter should initially move to one direction (Eg: + ve) and then move in the opposite direction when the magnet is moved away. Next move the magnet slowly, where the voltmeter should initially give a small reading and then give a large reading when the magnet is moved quickly.

(b) There is a changing magnetic field in the core of a transformer.

(i) Describe the cause of the changing magnetic field in the core of the transformer.

(2)

There is an alternating current in the primary coil of the transformer.

(ii) A potential difference of 230V is applied across the primary coil of a transformer.
There is a potential difference of 15V across the secondary coil.
The primary coil has 2000 turns.

Calculate the number of turns in the secondary coil.

Use an equation selected from the list of equations at the end of this paper.

(3)

$$\frac{V_P}{V_S} = \frac{N_P}{N_S}$$

$$\frac{230}{15} = \frac{2000}{N_S}$$

$$N_S = \frac{2000}{230} \times 15$$

$$= 130.43$$

$$\approx 130$$

130 turns

4 This question is about static electricity.

(a) A student has a rubber balloon tied to a long piece of cotton thread.

The student gives the balloon an overall electrostatic charge.

(i) Describe **one** way that the student could give the balloon an overall electrostatic charge.

(2)

Rub the balloon thoroughly with a cotton wool cloth

(ii) The student gives the balloon an overall negative charge.

Which of these sentences explains why the overall charge on the balloon is negative?

(1)

☒ **A** Negative charge has been removed from the balloon.

☒ **B** Negative charge has been added to the balloon.

☒ **C** Positive charge has been removed from the balloon.

☒ **D** Positive charge has been added to the balloon.

(iii) The student charges another balloon on a long thread.

Explain how the student can show that the two balloons have the same type of charge.

(3)

If the student holds the balloons by the long threads and bring them close to each other, they will repel each other if they have the same type of charge.

(b) Figure 9 shows a plastic block and a metal disc with an insulating handle.

The top surface of the plastic block has a negative charge.

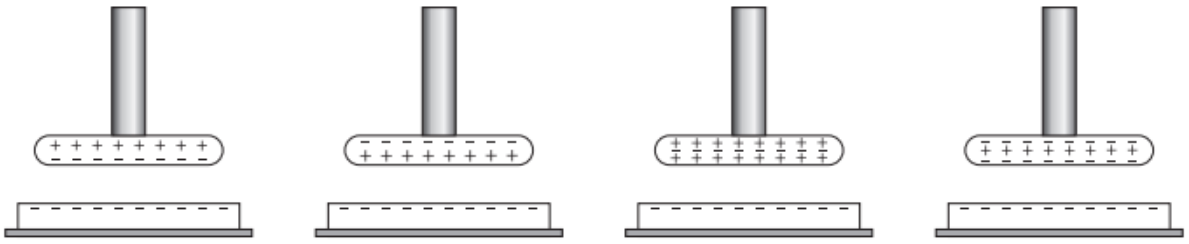
The metal disc has no overall electric charge.

Figure 9

A student uses the insulating handle to hold the metal disc above the plastic block.

(i) Which of these diagrams shows how the charge is distributed on the metal disc?

(1)



☒ **A** ☒ **B** ☒ **C** ☒ **D**

(ii) The student keeps holding the metal disc above the charged plastic block and taps the metal disc with a finger.

This earths the metal disc for a short time.

Explain why the disc now has an overall positive charge.

(2)

If the student tapped the top side of the metal disc, electrons that are pushed toward the top side might have moved out of the disc to the finger causing more positive charges to be in the disc compared to negative charges, producing an overall positive charge.

(iii) Figure 10 shows the charges on part of the metal disc and the plastic block.

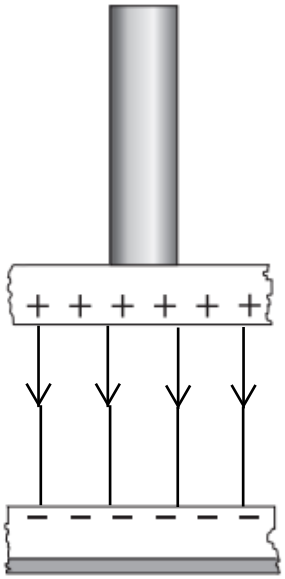


Figure 10

On Figure 10, draw lines to show the shape and direction of the electric field between the metal disc and the plastic block.

(2)

7 (a) Figure 15 shows three stages of a magnet moving into and then out of a coil of wire.

The coil is connected to a milliammeter.

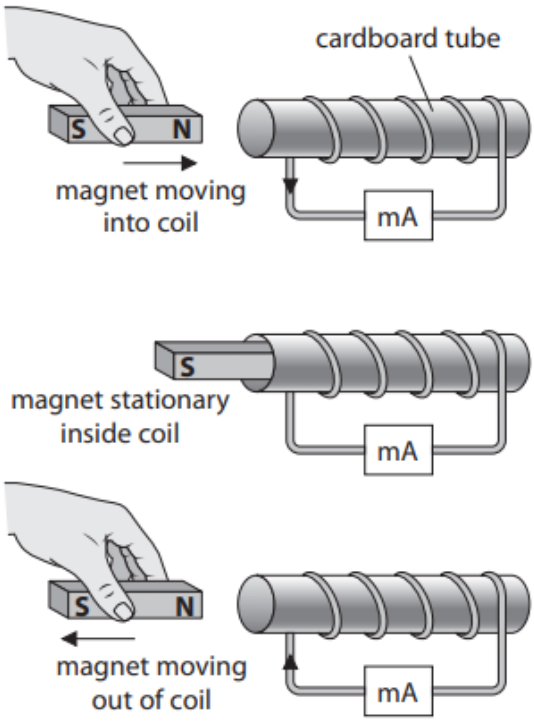


Figure 15

(i) Which row of the table shows the deflection on the milliammeter for the three stages in Figure 15?

(1)

	magnet moving into coil	magnet stationary inside coil	magnet moving out of coil
☐ A			
☐ B			
☒ C			
☐ D			

Figure 16

(ii) Give **two** ways of increasing the deflections on the milliammeter shown in Figure 16.

(2)

1 Moving the magnet faster into the coil

2 Increasing the number of turns in the coil.

(b) Figure 17 is a diagram representing a loudspeaker.

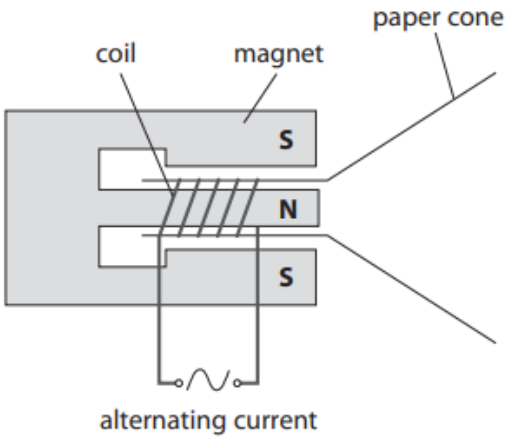


Figure 17

Explain how sound is produced when an alternating current is supplied to the coil of the loudspeaker.

(4)

When there is a current passing through the coil, there is a force induced on the coil. Since the current is alternating, the force is also alternating, which causes the coil to vibrate towards left and right. Since the paper cone is connected to the coil, the cone also vibrates, producing sound waves.

(c) Figure 18 shows a transformer.

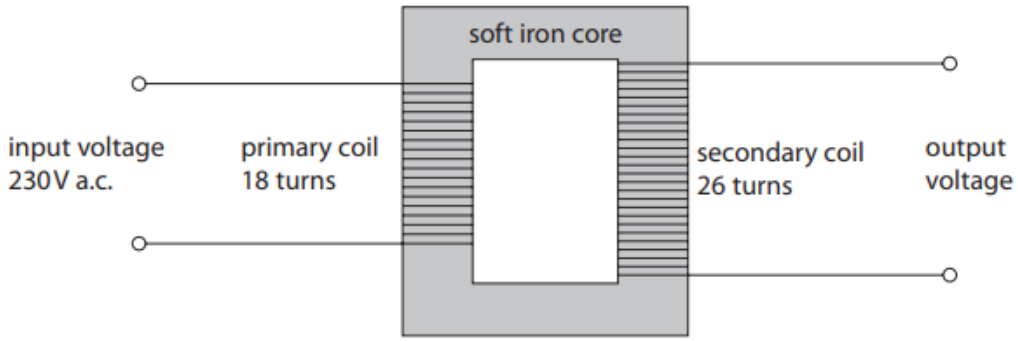


Figure 18

(i) State the purpose of the transformer shown in Figure 18.

(1)

Increase the voltage of the input alternating current.

(ii) Calculate the output voltage of the secondary coil.

Use an equation selected from the list of equations at the end of this paper.

(3)

$$\frac{V_P}{V_S} = \frac{N_P}{N_S}$$

$$\frac{230}{V_S} = \frac{18}{26}$$

$$V_S = 332.\dot{2} \approx 330$$

output voltage = 330 V

TOTAL FOR PAPER IS 62 MARKS