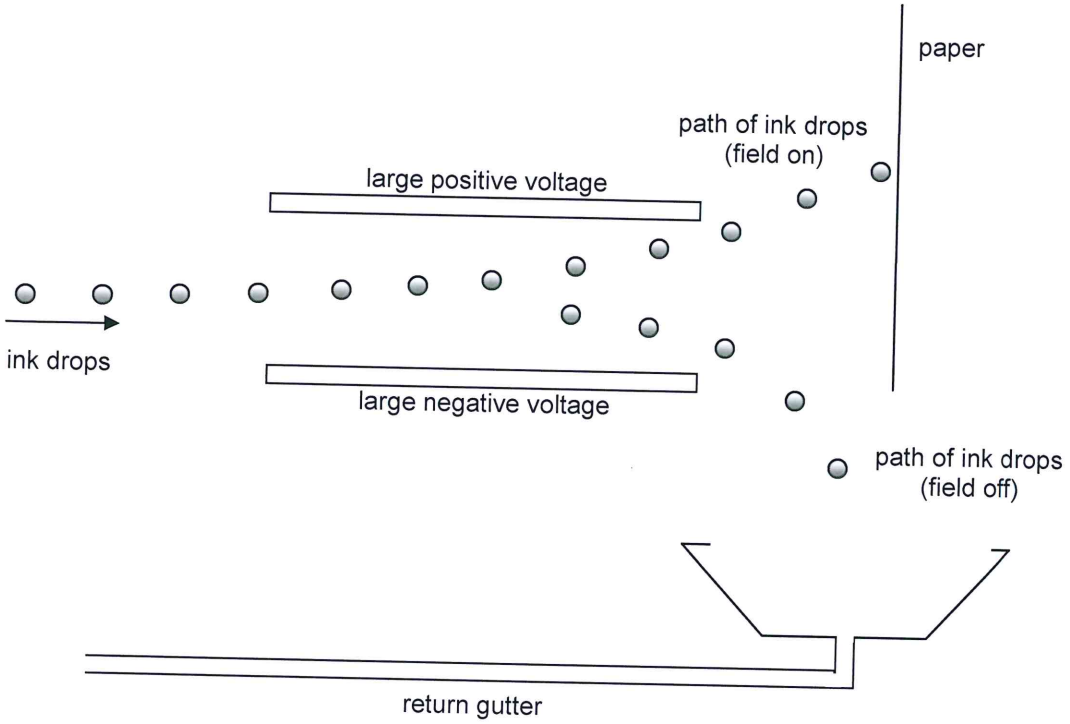
Exam Answers
Chapter 3·1 - Electric Fields
Answer 1 2010:1:5

(5 marks)

The principle of inkjet printing depends on the physics of charged particles in electric fields. The diagram below shows charged ink drops entering an electric field. The field is caused by high voltage deflection plates. The field on the plates switches on and off to direct drops to the paper rather than the gutter. Drops that do not impact on the page are 'recycled' via the gutter.



(a) The plates are separated by 0.025 m and the voltage difference between the plates is 1000 V. Calculate the electric field intensity. (2 marks)

Description	Marks
$E = \frac{1000}{0.025} = 40\,000$ V m^{-1} (or NC^{-1})	1–2
	Total 2

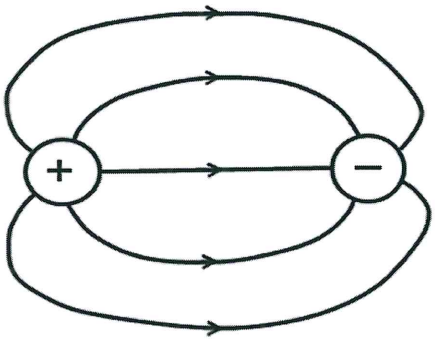
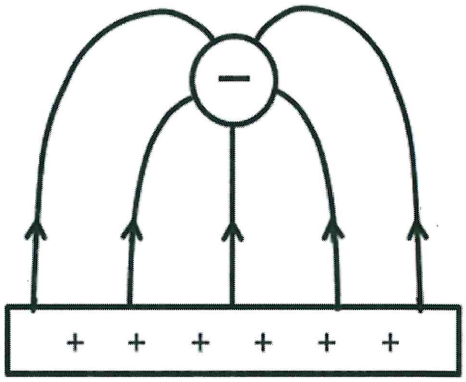
(b) If the force required to cause a black spot on the paper (i.e. so the drop goes onto the page, not into the gutter) is 10^{-8} N, calculate the charge on each drop. (3 marks)

Description	Marks
$F = Q.E$ $-1\times10^{-8} = Q \times 40\,000$ $Q = -2.5 \times 10^{-13}$ C	1–2
Negatively charged	1
	Total 3

Exam Answers
Chapter 3·1 - Electric Fields
Answer 2 2011:1:1

(3 marks)

Draw the resultant electric field with at least 5 lines for each of the following situations.

Two opposite but equally-charged spheres	A charged sphere near a charged conductive plate
	

Description	Marks
Field lines are from positive to negative	1
90° entry/exit and no crossing over	1
Evenly distributed across plate	1
	Total 3

Answer 3 2011:2:15

(10 marks)

An uncharged drop of oil is given 7 excess electrons. It is then introduced into the space between two horizontal plates 25.0 mm apart with a potential difference between them of 1.50 kV. The drop of oil remains stationary.

(a) Calculate the magnitude of the electric field strength between the plates. (2 marks)

Description	Marks
$E = V / d = 1500/0.025$	1
$E = 6.00 \times 10^4$ V m^{-1}	1
	Total 2

(b) Is the top plate positive or negative? Explain your reasoning. (2 marks)

Description	Marks
The top plate is positive.	1
This is because gravity is providing a downwards force on the drop since the drop is stationary the electric force must be upwards.	1
	Total 2

Exam Answers
Chapter 3·1 - Electric Fields
Answer 3 continued

(c) Calculate the magnitude of the electric force acting on the oil drop. (3 marks)

Description	Marks
$F = Eq = 6.00 \times 10^{4} \times 7 \times 1.6 \times 10^{-19}$	1–2
$F = 6.72 \times 10^{-14}$ N NB: penalise 1 mark for incorrect or no units.	1
	Total 3

(d) Calculate the mass of the oil drop. (3 marks)

Description	Marks
If oil drop is stationary then electric force = gravitational force $F_e = mg$	1
$m = F_e / g = 6.72 \times 10^{-14} / 9.8$	1
$m = 6.86 \times 10^{-15}$ kg NB: penalise 1 mark for incorrect or no units.	1
	Total 3

Answer 4 2014: 1: 7

(5 marks)

Shown below are three diagrams A, B and C representing fields. Use the diagrams to fill in the blanks in the following sentences. Any field diagram can be used more than once.

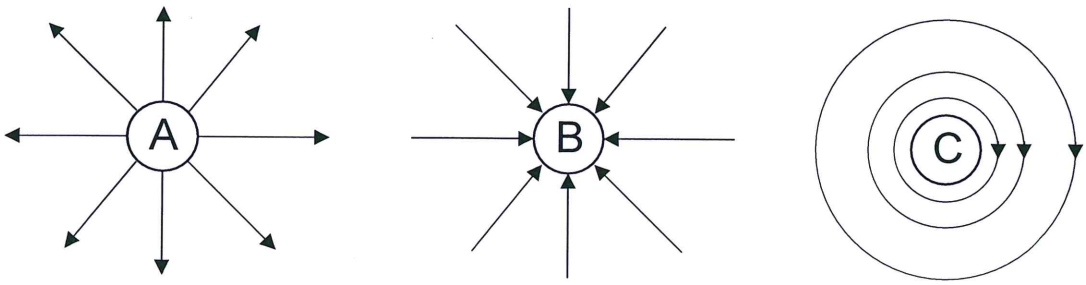


Diagram _____ could represent the gravitational field of a mass.

Diagram _____ could represent the electric field around a positively charged particle.

Diagram _____ could represent the electric field of a negatively charged particle.

Diagram _____ could represent the magnetic field around a wire carrying current that is directed_____ the page.

Description	Marks
B; A; B; C; Into	1–5
Total	**5**