Bangladesh International Tutorial Limited

Physics Worksheet

Class-XII

Worksheet-04

Subject Teacher- P.K. Saha

Total Marks- 40

Name: _____

1 The diagram shows the tracks from an event at point P in a bubble chamber. There is a uniform magnetic field directed into the page.

Which of the following is the reason why the tracks shown **cannot** represent the production of a proton-antiproton pair with equal kinetic energies?

☒ **A** The curvature is perpendicular to the magnetic field.

☒ **B** The tracks curve in different directions.

☒ **C** The tracks have different curvatures.

☒ **D** There is no track before point P.

(Total for Question 1 = 1 mark)

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2 The table compares the mass and charge of an electron with the mass and charge of a positron.

Select the line in the table that is correct.

	Mass	Type of charge
☒ **A**	equal	same
☒ **B**	equal	opposite
☒ **C**	unequal	same
☒ **D**	unequal	opposite

(Total for Question 2 = 1 mark)

3 Which of the following is a correct statement about uniform electric fields?

☒ **A** The field strength is the same at all points.

☒ **B** The field strength is the same in all directions.

☒ **C** The field produces no force on a stationary charged particle.

☒ **D** The force on a charged particle is perpendicular to the field.

(Total for Question 3 = 1 mark)

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4 In an electron gun, electrons are released from a heated filament.

What is this process called?

☒ **A** excitation

☒ **B** ionisation

☒ **C** photoelectric emission

☒ **D** thermionic emission

(Total for Question 4 = 1 mark)

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5 The diagram shows two horizontal parallel plates separated by a distance d. There is a potential difference V across the plates. An oil drop with charge Q is held stationary between the plates.

Which of the following gives the mass m of the oil drop?

☒ **A** $\frac{dg}{VQ}$

☒ **B** $\frac{VQ}{dg}$

☒ **C** $\frac{V}{Qdg}$

☒ **D** $\frac{Qdg}{V}$

(Total for Question 5 = 1 mark)

6 Which of the following is an equivalent unit to the tesla?

- ☐ **A** N A m
- ☐ **B** N A m^{-1}
- ☐ **C** N A^{-1} m
- ☐ **D** N A^{-1} m^{-1}

(Total for Question 6 = 1 mark)

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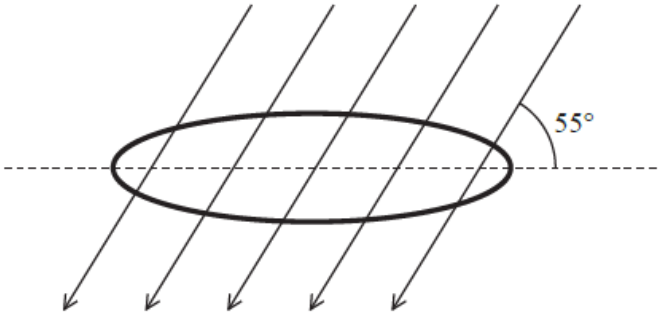
7 A magnetic field of flux density 4.0×10^{-3} T passes through a coil of wire, at an angle of 55° to the plane of the coil. The coil has an area of 2.5×10^{-3} m^2.

Calculate the magnetic flux through the coil.



- ☐ **A** 5.7×10^{-6} Wb
- ☐ **B** 8.2×10^{-6} Wb
- ☐ **C** 1.0×10^{-5} Wb
- ☐ **D** 1.4×10^{-5} Wb

(Total for Question 7 = 1 mark)

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8 A proton accelerates in an electric field and gains kinetic energy, giving it a change in momentum Δp. An alpha particle accelerates in the same electric field and gains the same kinetic energy.

The magnitude of the change in momentum of the alpha particle is given by

- ☐ **A** $\sqrt{2}\,\Delta p$
- ☐ **B** $2\Delta p$
- ☐ **C** $\sqrt{8}\,\Delta p$
- ☐ **D** $4\Delta p$

(Total for Question 8 = 1 mark)

9 A 4.0 μF capacitor discharges through a 560 kΩ resistor.
What is the time constant of the circuit?

☐ **A** 2.2×10^{-3} s

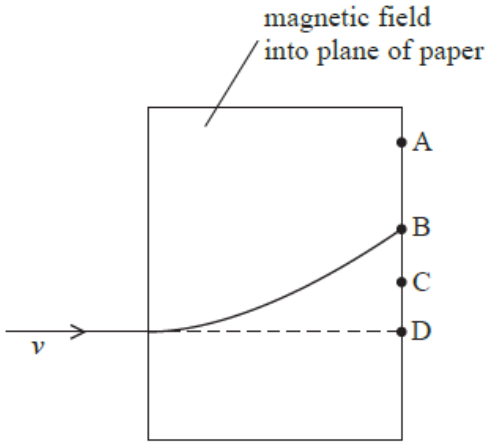
☐ **B** 4.5×10^{-1} s

☐ **C** 2.2×10^{0} s

☐ **D** 4.5×10^{2} s

(Total for Question 9 = 1 mark)

10 A proton enters a magnetic field. It has a velocity *v* perpendicular to the field. The diagram shows the path taken by the proton.



An alpha particle enters the magnetic field at the same point as the proton, also with velocity *v*.

At which point, A, B, C or D, is the alpha particle most likely to leave the magnetic field?

☐ **A**

☐ **B**

☐ **C**

☐ **D**

(Total for Question 10 = 1 mark)

11 The International Space Station (ISS) completes 16 orbits of the Earth every 24 hours. The ISS is 330 km above the surface of the Earth.

(a) Show that the angular velocity of the ISS around the Earth is about 1×10^{-3} rad s^{-1}.

(2)

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.....

(b) Calculate the acceleration of the ISS in this orbit.

radius of Earth = 6400 km

(2)

.....

.....

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.....

Acceleration of the ISS = ...

(Total for Question 11 = 4 marks)

12 There are two families of hadrons called mesons and baryons.

(a) State the structure of a meson.

(1)

.....

.....

(b) The table shows the charge on up and down quarks.

Quark	Charge / *e*
up	+2/3
down	–1/3

Use the information in the table to state the quark composition of an antiproton and an antineutron.

(2)

Antiproton .....

.....

Antineutron .....

.....

(c) A proton has kinetic energy of 158 MeV. It annihilates with a stationary antiproton and two photons of equal energy are created.

Calculate the wavelength of the photons.

mass of stationary proton = 938 MeV/c^2

mass of stationary antiproton = 938 MeV/c^2

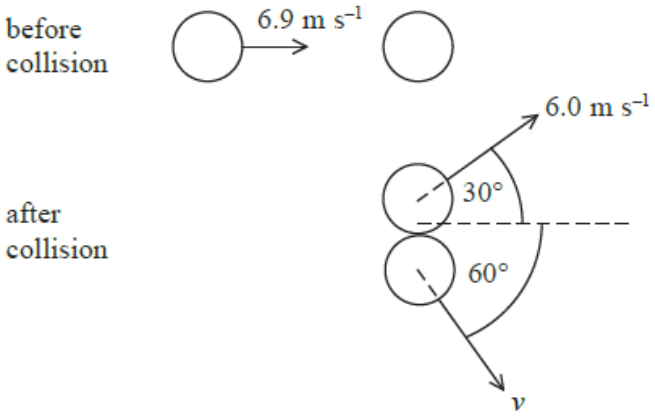
(4)

Wavelength of the photons = ...

(Total for Question 12 = 7 marks)

13 In the game of air hockey, small identical discs move across a frictionless surface.

One disc moving with a velocity of 6.9 m s^{-1} collides with a stationary disc. After the collision the discs move apart as shown in the diagram.



(a) Calculate the velocity v.

(3)

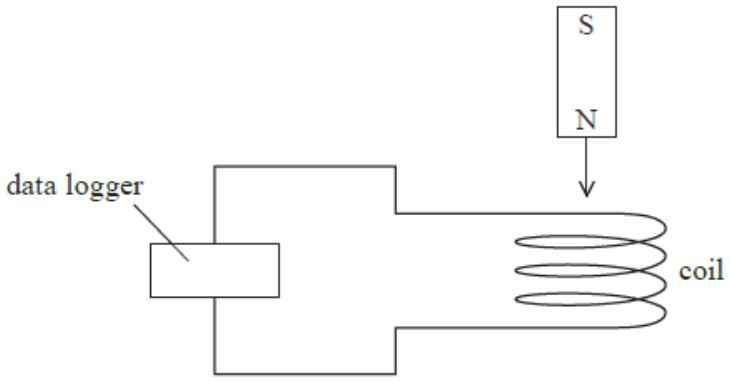
v = ...

(b) Explain whether the collision is elastic or inelastic.

(2)

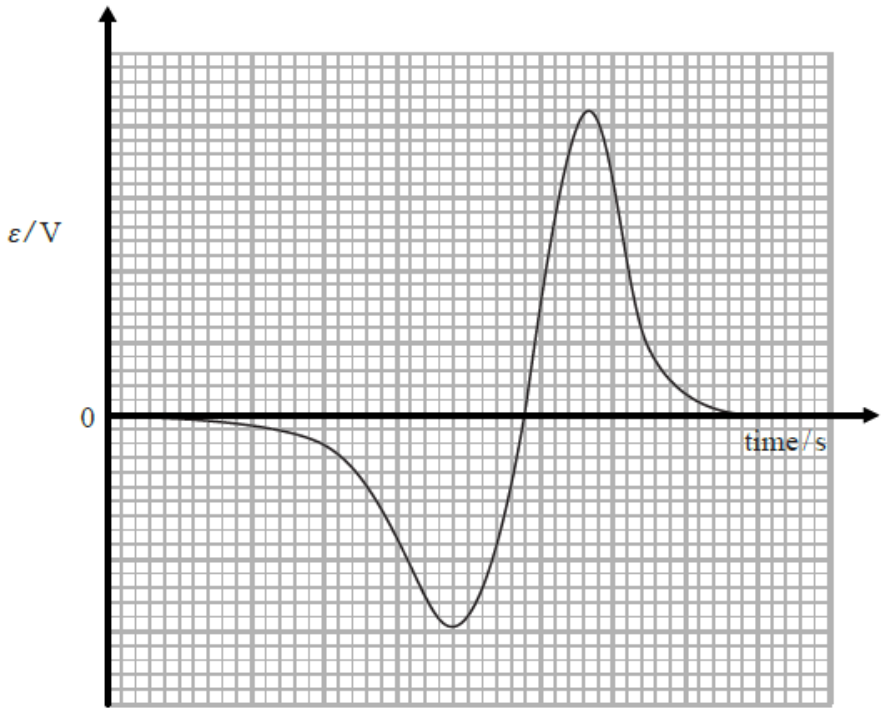
(Total for Question 13 = 5 marks)

14 A student is investigating the laws of electromagnetic induction. She drops a bar magnet through the centre of a coil of wire as shown.



As the bar magnet falls through the coil an e.m.f ε is induced.

The graph shows how ε varies with time t.



*(a) Explain the shape of the graph.

(5)

(b) A data logger was used in this experiment rather than a voltmeter.

Describe experimental conditions that make a data logger most suitable for collecting data.

(2)

(Total for Question 14 = 7 marks)

15 The photograph shows part of the cycling track used in the London 2012 Olympic Games. On the bend the track is banked so that the outside of the track is higher than the inside of the track.

The diagram shows the forces R and W acting on a cyclist travelling at a constant speed around the bend.

(a) Explain why there must be a resultant force acting on the cyclist.

(2)

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(b) Explain why a banked track is an advantage to cyclists.

(2)

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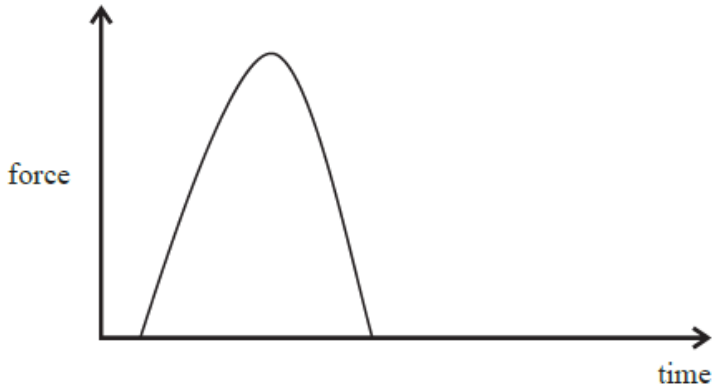
(c) An inflatable airbag helmet for cyclists has been designed to prevent head injuries. It is worn like a scarf around the neck. In-built sensors detect when the cyclist is involved in a crash and inflate the airbag over the cyclist's head in 0.1 s.

The graph shows how the force on a cyclist's head during a collision varies with time when an airbag is not used.



Add to the axes, the graph that shows how the force on a cyclist's head during a collision varies with time when the airbag is used.

Justify the shape of your graph.

(3)

(Total for Question 15 = 7 marks)