
UNIVERSITI SAINS MALAYSIA

Final Examination
Academic Session 2007/2008

April 2008

JIF 103 – Physics 1/ Practical 1a
[JIF 103 – Fizik 1/ Amali 1a]

Duration : 3 hours
[Masa : 3 jam]

Please ensure that this examination paper has **SEVEN** printed pages before you answer any questions.

Answer **ALL** questions. You may answer **either** in Bahasa Malaysia or in English.

Read the instructions carefully before answering.

Each question carries 100 marks.

*Sila pastikan kertas peperiksaan ini mengandungi **TUJUH** muka surat yang bercetak sebelum anda menjawab sebarang soalan.*

*Jawab **SEMUA** soalan. Anda dibenarkan menjawab soalan **sama ada** dalam Bahasa Malaysia atau Bahasa Inggeris.*

Baca setiap arahan dengan teliti sebelum menjawab.

Setiap soalan bernilai 100 markah.

1. (a) Is spacetime absolute? Justify your answer.
(20 marks)
- (b) Alpha Centuri is a star in our galaxy and is situated 4.3 light-years away from Earth. Sheikh Muzaphar boards a rocket and leaves for Alpha Centuri. If his rocket travels at $0.95c$ relative to the Earth,
 - (i) by how much will he have aged, according to his clock, when he reaches his destination?
(30 marks)
 - (ii) what is the distance between Earth and Alpha Centuri as measured by him?
(30 marks)
 - (iii) what is the speed of a laser beam as measured by the mission control on Earth when he fires a beam of laser light towards them?
(20 marks)
2. (a) Explain why a particle cannot reach the speed of light.
(30 marks)
- (b) A pi meson decays into a muon and a massless neutrino. If the mass of the muon is known to be $106 \text{ MeV}/c^2$, and the kinetic energy of the muon is measured to be 4.6 eV , determine the mass of the pi meson.
(70 marks)

3. For a photoelectric effect experiment,
- (a) sketch its experimental set-up. (10 marks)
 - (b) sketch appropriate graphs representing the experimental findings. (30 marks)
 - (c) imagine you are discussing about the experimental findings with Einstein and a Newtonian scientist.
 - (i) How would the Newtonian scientist explain the findings? (30 marks)
 - (ii) How would Einstein explain the findings? (30 marks)
4. (a) If light can have particle-like properties, can matter have wave-like properties? Give your answer supported with experimental evidence (if any). (50 marks)
- (b) (i) State the Heisenberg Uncertainty Principle. (10 marks)
 - (ii) How does a Bohr atom violate the Uncertainty Principle? (40 marks)
5. If Thomson, Rutherford and Bohr were to have a discussion about the atomic model,
- (a) how would Thomson explain his atomic model? (20 marks)
 - (b) what experimental evidence would Rutherford put forward to refute Thomson's atomic model? (40 marks)
 - (c) why would Bohr reject Rutherford's atomic model? What is his suggestion to the Rutherford atomic model? (40 marks)

1. (a) Adakah ruang-masa mutlak? Justifikasikan jawapan anda.
(20 markah)
- (b) Alpha Centuri, sebuah bintang dalam galaksi kita berada sejauh 4.3 tahun cahaya dari bumi. Sheikh Muzaphar menaiki sebuah roket menuju ke Alpha Centuri. Jika roket tersebut bergerak $0.95c$ relatif pada bumi, berapakah
 - (i) umurnya bertambah, pada pengukuran jamnya, apabila dia sampai ke destinasi?
(30 markah)
 - (ii) jarak antara bumi dan Alpha Centuri pada pengukurannya?
(30 markah)
 - (iii) laju bim laser pada pengukuran pengawal misi di bumi sekiranya dia menyuluh cahaya laser ke arah mereka?
(20 markah)
2. (a) Mengapakah zarah tidak boleh mencapai kelajuan cahaya? Jelaskan jawapan anda.
(30 markah)
- (b) Satu pi meson mereput menjadi satu muon dan satu neutrino tanpa jisim. Sekiranya jisim muon diketahui adalah $106 \text{ MeV}/c^2$, dan pengukuran tenaga kinetik muon memberikan nilai 4.6 eV , tentukan jisim pi meson.
(70 markah)

3. Bagi satu eksperimen fotoelektrik,
- (a) lakarkan tatasusunan alatan eksperimen. (10 markah)
 - (b) lakarkan graf-graf dapatan eksperimen. (30 markah)
 - (c) bayangkan anda berbincang mengenai dapatan eksperimen tersebut dengan Einstein dan ahli sains berfahaman Newton.
 - (i) Bagaimanakah ahli sains berfahaman Newton menerangkan dapatan eksperimen tersebut? (30 markah)
 - (ii) Bagaimanakah Einstein menerangkan dapatan eksperimen tersebut? (30 markah)
4. (a) Jika cahaya boleh mempunyai ciri zarah, bolehkah jirim mempunyai ciri gelombang? Berikan jawapan anda dengan sokongan bukti eksperimen (sekiranya ada). (50 markah)
- (b) (i) Nyatakan Prinsip Ketaktentuan Heisenberg. (10 markah)
- (ii) Bagaimanakah atom Bohr melanggar Prinsip Ketaktentuan ini? (40 markah)
5. Sekiranya Thomson, Rutherford dan Bohr berpeluang berbincang mengenai model atom,
- (a) bagaimanakah Thomson menjelaskan model atomnya? (20 markah)
 - (b) apakah bukti eksperimen yang akan diketengahkan oleh Rutherford bagi menyangkal model atom Thomson? (40 markah)
 - (c) mengapakah Bohr menolak model atom Rutherford? Apakah penyelesaian yang dia ajukan terhadap model atom Rutherford? (40 markah)