**Physics Paper 1**

 **SECTION A**

1.(a) Define the terms;

 (i) Uniform acceleration [01 mark]

 (ii) Time of flight for a projectile [01 mark]

 (b) (i) Sketch a displacement time graph showing uniformly accelerated motion. [01 mark]

 (ii) A body starts from rest and accelerates uniformly at an acceleration, $a$, to a velocity, $v$, covering a distance, $s$, in a time, $t$, derive an expression relating $v$, $a$ and $s$. [03 marks]

 (iii) Show that the above equation is dimensionally correct. [03 marks]

 (c) (i) State the law of conservation of energy. [01 mark]

 (ii) An inflated ball falls from a height of 10 m and lands o a hard floor. The ball rebounds to a maximum height of 4.5 m after impact.

 Calculate the impulse on the floor. [04 marks]

(d) (i) Distinguish between perfectly elastic collision and perfectly inelastic collision. [02 mark]

 (ii) A billiard ball of mass $M\_{1}$ moving at a velocity, $u$ collides head on with another ball at rest of mass $M\_{2}$. If the resulting collision is elastic, show that the velocity, $V\_{1}$ of ball mass $M\_{1}$ is given by,

 $V\_{1}=\left(\frac{M\_{1}-M\_{2}}{M\_{1}+M\_{2}}\right)u$ . [04 marks]

2. (a)(i) State Kepler's laws of planetary motion. [03 marks]

 (ii) Deduce the dimensions of the universal gravitation constant G using

 Newton's law of gravitation and state its units. [03 marks]

 (iii) Derive an expression for the period, *T*  of the planet moving in a

 circular orbit about the sun in terms of the radius of the orbit, *R*

 and the mass of the sun $M\_{s}$. [04 marks]

 (b)(i) Calculate the mechanical energy of a satellite of mass 600 kg in a

 circular orbit at a height 2000 km above the earth's surface. [04 marks]

 (ii) Explain why resistance to forward motion of the satellite may result

 into increase in the speed of the satellite. [03 marks]

 (c)(i) What is meant by escape velocity? [01 mark]

 (ii) Sketch a graph of to show the variation of acceleration due to gravity

 with distance from the centre of the earth. [02 marks]

3.(a) (i) State the laws of solid friction. [03 marks]

 (ii) Describe an experiment to determine the coefficient of dynamic

 friction between two wooden surfaces in contact. [05 marks]

(b)

*m*

 Table

3.0 kg

Pulley

 A block of mass 3.0 kg placed on a horizontal table is pulled by a mass, *m* using an inextensible string that passes over a frictionless pulley as shown in figure above. The block moves with constant velocity when *m* = 600 g.

 Calculate the coefficient of friction between the block and the table. [04 marks]

c) (i) Draw a sketch diagram showing the forces acting on a bicycle rider round a circular track inclined at angle *θ* to the vertical. [02 marks]

 (ii) Derive an expression for the angle inclination, *θ* in terms of the speed*,V,* accelaration due to gravity*, g* and the *r*adius of the circular truck*,r*. (d) Explain why a racing car car travel faster on a banked track than on a flat track of the same radius of curvature. [03 marks]

4.(a)(i) State Newton's laws of motion. [03 marks]

 (ii) Use Newton's laws to show that $F= ma$. [05 marks]

 (b) A ball of mass 0.5 kg is projected from the horizontal ground towards a vertical wall with a speed of 18.0 m s-1 at an angle of 30 0 to horizontal. The ball falls to a spot on the ground 8.0 m away from the wall after bouncing off. If the wall is 14.3 m away from the point ofprojection it stays in contact with the wall for a period of 5.0× 10-2 s, find

 (i) time it takes the ball to hit the wall from the point it is projected. [02 marks]

 (ii) the force that the ball exerts on the wall. [04 marks]

 (c)(i) Define relative velocity.

 (ii) A man who can at 5.0 m s-1 in still water wants to cross a river 20.0 m wide flowing at 3.0 m s-1 to a point 5 m downstream. Find the velocity he should use to achieve this. [05 marks]

 SECTION B

5(a)(i) What is meant by the term triple point of water as applied to thermometry ? [01 marks]

 (ii) How is temperature on the Celsius scale defined on the platinum

 resistance thermometer. [03 marks]

 (iii) The resistance platinum thermometer is 5.2 Ω at the triple point of

 water and 9.1 Ω at an unknown temperature $θ$. Find the value of $θ$. [04 marks]

 (iv) State the desirable properties a material must have to be used as a thermometric substance. [02 marks]

 b)(i) Describe with the aid of a labelled diagram, how to measure high

 temperatures using an optical pyrometer. [06 marks]

 (ii) A liquid in glass Thermometer uses liquid of which the volume varies with temperature t 0c according to the relationship , where are the volumes at

 temperature t 0C and 0 0C on the gas thermometer respectively and a

 and b are constants. If a = b x103, Calculate the temperature indicated by the liquid in glass thermometer when the gas thermometer reads 1000 0C. [04 marks]

6. (a) (i) Define thermal conductivity. [01 mark]

 (ii) Explain the mechanism of heat transfer by convection. [03 marks]

 (b) (i) State Newton's law of cooling. [01 mark]

 (ii) Describe briefly an experiment to verify Newton's law of cooling. [05 marks]

 (c) A wall is constructed using two types of bricks. The temperatures of the inner and outer surfaces of the wall are 29 0C and 21 0C

 respectively. The value of the thermal conductivity for the inner brick is 0.4 W m-1 K-1 and that of the outer brick is 0.8 W m-1 K-1.

 (i) Explain why in steady state the rate of thermal energy transfer is the same in both layers. [02 marks]

 (ii) If the layer is 12.0 cm thick, find the temperature at the interface between the layers. [04 marks]

(d) Explain the greenhouse effect and how it leads to rise of the earth

 temperature. [04 marks]

7.(a) (i) Draw sketch graphs to show the variation of relative intensity of black body radiation with wavelength for three different temperatures. [02 marks]

 (ii) Explain the appearance of a metal ball placed in a dark room when its temperature is progressively raised from room temperature to just below melting. [03 marks]

 (iii) Explain why cavities in a fire look brighter than the rest of the fire.

(b) (i) State Wien’s and Stefan’s laws of black body radiation. [02 marks]

 (ii) The intensity of radiant energy from a black body is a maximum at a wavelength of 1.5 x 10-6 m. Calculate the temperature of the black body. [02 marks]

 (iii) Describe an experiment to compare surfaces as absorbers of radiation.

 (c) The energy intensity received by a spherical planet from a star is 1.4 x 103 Wm-2. The star is of radius 7.0 x 105 km and is 1.4 x 108 km from the planet from the planet.

 (i) Calculate the surface temperature of the star. [04marks]

 (ii) State any assumptions you have made in (c) (i) above. [01 mark]

 **SECTON C**

8.(a) What is meant by the following;

 (i) Radioactivity [01 mark]

 (ii) Isotopes? [01 mark]

 (b) (i) Define mass defect. [01 mark]

 (ii) State the condition for a heavy nucleus of an atom to be unstable. (iii) Explain your answer in b (ii). [02 marks]

 (c) A sample of $$ emits both $α$- particles and $γ$-rays. A mass defect of 0.0053 u occurs in the decay.

 (i) Calculate the energy released in joules. [03 marks]

 (ii) If the sample decays by emission of $α$- particles, each of energy 4.60 MeV and $γ$-rays, find the frequency of the $γ$-rays emitted. [04 marks]

 (d)(i) Sketch of graph showing the variation of binding per nucleon with mass number, clearly showing the fusion and fission regions. [02 marks]

 (ii) Use the sketch graph in d(i) to explain how energy is released in each of the processes of fusion and fission.

 (e) State two

 (i) applications of radioisotopes. [01 mark]

 (ii) health hazards of radioisotopes. [01 mark]

9.(a) What are x-rays? [01 mark]

 (b) (i) With the aid of a diagram explain how X-rays are produced in an X-ray tube. [05 marks]

 (ii) State the energy changes that take place in the production of X-rays in an X-ray tube. [02 mk]

(c) In an X-ray tube, the electrons strike the target with a velocity of 3.75× 107 m s-1 after travelling a distance of 5.0 cm from the cathode. If the current of 10 mA flows through the tube, find the

 (i) tube voltage. [02 marks]

 (ii) number of electrons striking the target per second. [02 marks]

 (iii) number of electrons within a space of 1 cm length between the anode and cathode.[05 marks]

(d) Briefly explain one medical application of X-rays. [03 marks]

10.(a) Define the following:

 (i) Specific charge. [01 mark]

 (ii) Positive rays. [01 mark]

 (b) Explain the mechanism of thermionic emission. [03 marks]

(c)(i) Distinguish between cathode rays and positive rays. [04 marks]

 (ii) Describe an experiment to determine the specific charge of positive ions.

 (d) A beam of electrons is accelerated through a potential difference of

 2.0 kV and directed mid-way between two horizontal metal plates of length 4.0 cm separated by a distance of 2 mm. If the P.D across the plates is 80 V and the screen is placed 20 cm from the edge of the glass plates calculate the:

 (i) Speed of the electrons as they enter between the plates. [02 marks]

 (ii) Deflection of the electrons on the screen. [03 marks]

  **END**

**PHYSICS PAPER 2**

Attempt any three questions of your choice

1. (a) (i) state the law of reflection of light. (2marks)

 (ii) With a aid of a diagram, describe the operation of an optical lever in a mirror galvanometer. (4marks)

(b) Describe an experiment to determine the focal length of a concave lens using a convex lens and a plane mirror. (4 marks)

(c) Figure and show the ray of monochromatic light incident on triangular glass prism at an angle of incident 0. Light just merges from the force AB of the prism. The speed of light in the prism 2.0 x 108ms-1.

 

 (i) Calculate the refractive index of the glass. (2marks)

 (ii) Find the value of θ. (3marks)

 (iii) Explain what happens when the angle of incidence is greater than θ. (5marks)

1. (a) Define the following

 (i) Electric field intensity. (2marks)

 (ii) Electric potential (2marks)

(b) (i) State coulomb’s law of electrostatics. (2marks)

 (ii) Describe how a conducting body may be positively charged but remains at zero potential. (5 marks)

(c) Find the force between the point charges -4.0μc and -7.0μc placed at a distance of 20cmapart in air. (5marks)

(d) State the law of electrostatics. (1mark)

1. (i) Define capacitance of a capacitor (1mark)

(ii) Sketch a graph of current against time. (2 marks)

(b) Describe the experiment to determine the effect of the separation of the plates on capacitance of a capacitor. (4marks)

(c) Explain the effect of replacing a dielectric by feline the space between the plates’s of a charged capacitor with a conductor. (5marks)

(d) (i) What is meant by relative permittivity of an insulating material? (2marks)

 (ii) Describe how the relative permittivity of an insulating material is determined by using a ballistic galvanometer. (5 marks)

1. (i) Define electric field? (1mark)

(ii) State the properties of the electric field lines. (3 marks)

(b) Draw an electric field line for two equal unlike point charges near each other. (c) Define electric potential. (1 mark)

(ii) Derive an expression for the electric potential at a distance r from a point charge Q situated in a vacuum.

(d) Sketch a graph of electric field intensity against distance from the centre of sphere. (2marks)