JUNE 2001

SECTION A

ANSWER ONLY TWO QUESTIONS

1 (a)

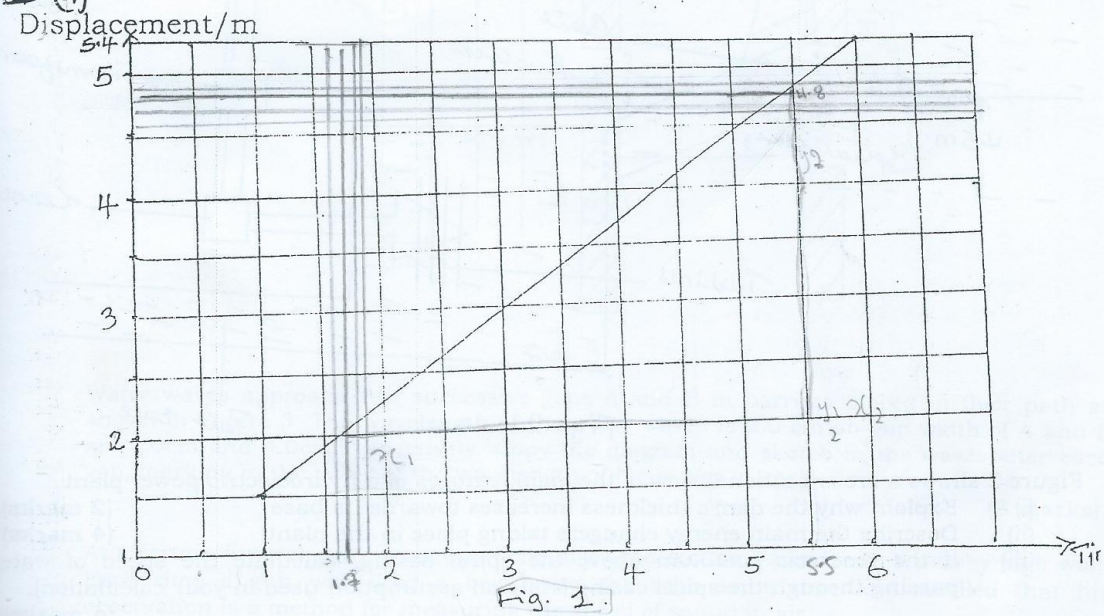

Fig. 1

Figure 1 shows the displacement – time graph of a ball X, rolled along a straight horizontal groove AB by giving it an initial push. The displacements are measured from the end A of the groove.

(i) Use the graph to determine the velocity of the ball

(3 marks)

(ii) Explain whether the groove is smooth or rough

(2 marks)

(iii) Use the graph (without any calculation) to find the initial displacement of the ball from the end A of the groove and hence calculate its full length AB if the ball takes 11.0s top reach B

(4 marks)

(iv) If in its motion ball X collides with a stationary identical ball Y, giving Y a velocity of 0.5m/s, state the law of conservation of momentum and use it to find the velocity of ball X after the collision

(4 marks)

(b) A tennis ball of mass 0.08kg is dropped from a height of 6.0m onto a level floor and it bounces back to a height of 4.5m

(i) Sketch a velocity time graph for the motion of the ball

(2 marks)

(ii) Explain why the ball does not bounce back to a height of 6.0m

(2 marks)

22(a)

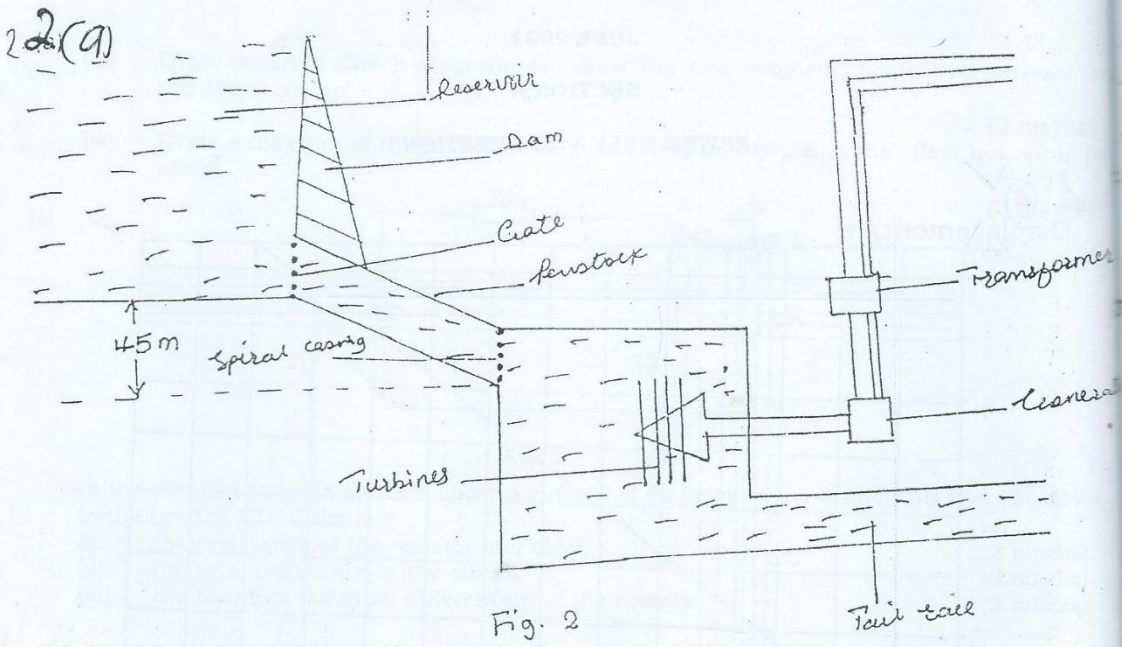

Fig. 2

Figure 2 shows a cross-sectional view of the main features of a hydroelectric power plant

(i) Explain why the dam's thickness increases towards its base **(2 marks)**

(ii) Describe the main energy changers taking place in the plant **(4 marks)**

(iii) If the reservoir is 45.0m above the spiral casing, calculate the speed of water passing through the spiral casing (state an assumption used in your calculation). **(4 marks)**

(iv) If the water supplies a power of 6.75×10^7W to the turbines whose efficiency is 90%, calculate the power supplied to the generator. **(2 marks)**

(v) What is the function of the transformer at the end of the plant? **(2 marks)**

(b) (i) Define density **(1 mark)**

(ii) Water is denser than kerosene. Explain how you would use these two liquids and any other simple equipment that you might need to illustrate the meaning of this statement of our sister in Form One. **(3 marks)**

3 (a) (i) State two ways in which radio waves and sound waves differ

(2 marks)

(ii) Explain why sound from a loud-speaker is louder than that from a telephone earpiece

(3 marks)

(b)

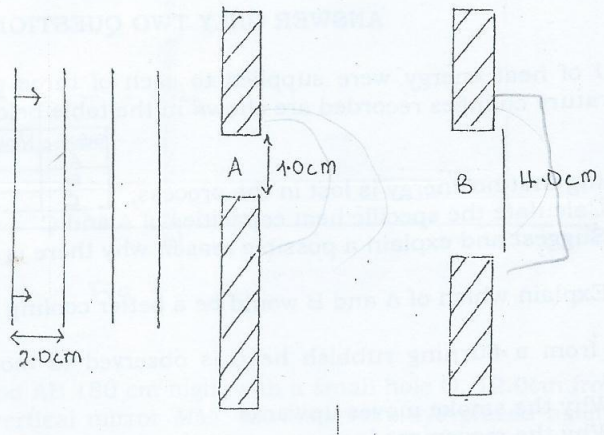

Fig. 3

Water waves approach two successive gaps A and B in barriers placed in their path as shown in Figure 3. The wavelength of the water waves is 2.0 cm an gap width of A and B are 1.0cm and 4.0cm respectively. Copy the diagram and sketch in the waves after each gap, marking in the value of the wavelength of the waves in each case

(3 marks)

(c) At a certain funeral, gun firing was done at a good distance away from a nearby high wall. Each time a gun was fired a boy heard the echo some time and recalled that his observation is a method for measuring the speed of sound in air.

(i) What property of sound in the cause of the echo?

(1 mark)

(ii) Explain precisely what measurements would have to be made in this case and how these measurements would be used to calculate the speed of sound in air

(6 marks)

(iii) Explain why the sound of a gunshot would become simply prolonged if firing were done much closer to the wall

(2 marks)

SECTION B

ANSWER ONLY TWO QUESTIONS

4. (a) 4500 J of heat energy were supplied to each of three substances A, B and C, and the temperature changes recorded are shown in the table below.

Substance	Mass (kg)	Temperature change (K)
A	6.0	0.75
B	1.5	0
C	3.75	1.75

Assuming that no energy is lost in the process,

(i) Calculate the specific heat capacities of A and C (3 marks)

(ii) Suggest and explain a possible reason why there is no temperature change in B. (2 marks)

(iii) Explain which of A and B would be a better cooling liquid (2 marks)

(b) Smoke from a burning rubbish heap is observed to move upwards in a wavy manner. Explain

(i) Why the smoke moves upwards (2 marks)

(ii) Why the movement is wavy (2 marks)

(iii) How the movement of the smoke is different from Brownian motion (2 marks)

(c) Hot tea from the same flask is served into two cups of the same shape and same volume, one made of glass and the other of silver. States, giving a reason in each case.

5. (a) Give a brief physical explanation of each of the following observations:

(i) When the mouth of a bicycle pump is blocked by placing the thumb over it the force needed to push the piston in by 1.0cm increases as the piston moves further in. (2 marks)

(ii) A liquid becomes colder as some of it evaporates (2 marks)

(b) In an experiment to investigate the variation of volume with temperature of a fixed mass of gas, the following results were obtained.

Temperature/^{0}C	15.0	40.0	65.0	80.0	90.0
Volume/x $10^{-6}m^3$	7.0	7.6	8.2	8.6	8.8

(i) Plot a graph of volume (y-axis) against temperature (x-axis) (4 marks)

(ii) Find the gradient of the graph (2 marks)

(iii) What information does the gradient give about the way the volume varies with temperature? (2 marks)

(c) A narrow uniform glass tube contains air enclosed by a thread of mercury 15.0cm long. Given that atmospheric pressure is 75.0cmHg calculate the pressure on the trapped air

(i) When the tube is held vertical with the open end uppermost (1 mark)

(ii) When the tubes is held vertical with the open end uppermost (1 mark)

(iii) Calculate the ratio of the volumes of the gas in (i) and (ii) above (1 mark)

(iv) What assumption have you made in your calculation in (iii) above? (1 mark)

(v) Explain what the phrase *atmospheric pressure is 75.0 cmHg* means. (1 mark)

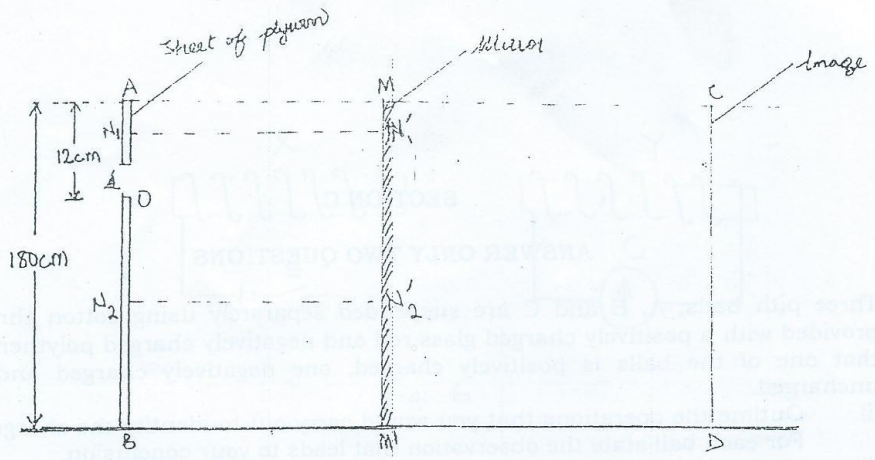

Fig 4

Figure 4 shows a sheet of plywood AB 180 cm high, with a small hole O, 12.0cm from its top. I is placed vertically in front of vertical mirror MM^1. An observer's eye placed against the hol from the back sees the full length of the plywood in the mirror as far behind as the plywood is in front. N_1N^1 is a normal to the mirror surface at the point of incidence of one ray from A anc bisects AO while N2N1 is a normal to the mirror surface at the point of incidence of one ray from B and bisects OB.

(i) Copy the diagram and use two rays from the plywood to show how the eye sees th full length of the plywood in the mirror. Indicate the angles of incidence anc reflection for one of the rays

(4 marks)

(ii) Determine the minimum length of the mirror that has been used in seeing the ful length of the image

(4 marks)

(iii) State any other property of the image not mentioned in the question

(1 mark)

(b) (i) Explain with respect to sir, what is meant by the critical angle of an optical medium

(2 marks)

(ii) State two conditions necessary for total internal reflection to occur and one devic whose functioning depends on total internal reflection.

(3 marks)

(c) A certain lens held 4.0 cm above a small object on the table forms a clear image four time the size of the object and on the same side of the lens as the object

(i) State, giving a reason, the type of lens used **(2 marks)**

(ii) How far is the mage from the lens **(2 marks)**

SECTION C

ANSWER ONLY TWO QUESTIONS

7. (a) Three pith balls, A, B and C are suspended separately using cotton threads. You are provided with a positively charged glass rod and negatively charged polythene rod and told that one of the balls is positively charged, one negatively charged and the other is uncharged.

(i) Outline the operations that you would carry out to identity the charge on each ball. For each ball state the observation that leads to your conclusion. **(5 marks)**

(ii) How might each rod have been charged and what particles are transferred during the process? **(3 marks)**

(b) A fuse and an earth wire are protective devices

(i) What does each protect and how? **(6 marks)**

An electric iron is rated 1000W, 250V

(ii) To what part of the iron is the earth wire connected? **(1 mark)**

(iii) Determine the value of the appropriate fuse for this iron? **(2 marks)**

8. (a)

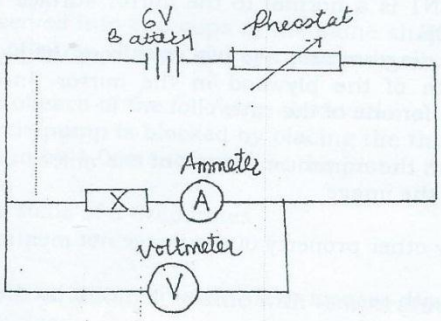

Fig. 5

Figure 5 shows the circuit for investigating how the current (I) through an electrical component X varies with p.d (V) across it. The voltmeter has an infinitely high resistance.

(i) How is the current through the component X varied? **(1 mark)**

(ii) Though the voltmeter is connected across X and the ammeter, its reading gives the p.d. across X only. What property must the ammeter have for this to be true? Explain **(2 marks)**

(iii) Sketch the current (I) versus p.d. (V) graph you would expect if component X were a filament lamp **(1 mark)**

(iv) If the ammeter reads 2.0 A when the rheostat is set at 2.0, determine the reading of the voltmeter and hence the resistance of X at that instant. **(4 marks)**

(b) (b)

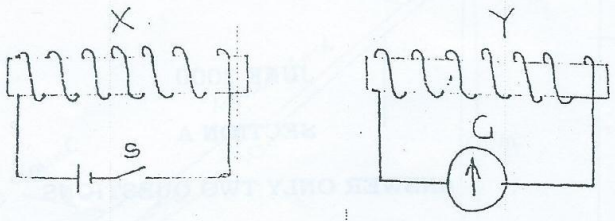

Fig. 6

Figure 6 shows two coils X and Y placed end to end without touching each other X is in series with a battery B and a switch S. while Y is in series with a centre zero galvanometer G. When switch S is closed the galvanometer shows a momentary deflection.

(i) Copy the diagram and sketch in the magnetic field of coil X when the switch is closed. Indicate its polarity. **(3 marks)**

(ii) Explain why the galvanometer shows a deflection when the switch is closed **(2 marks)**

(iii) State one other way of manipulating coil X to produce a momentary deflection of the galvanometer with the switch closed. **(1 mark)**

(iv) Name a device whose functioning depends on the above principle and explain briefly how it works. **(3 marks)**

9. (a) Unstable nuclei decay by emitting either alpha or beta particles. Two nuclei A and B are known to be unstable, A due to an excess of protons and B due to an excess of neutrons.

(i) Write down the nucleon number-proton number notation for an alpha particle and a beta particle. **(2 marks)**

(ii) State and explain which radioactive particle each nucleus should emit during decay to become more stable. **(4 marks)**

(iii) Write an equation to show how a beta particle emitted during decay is produced from a neutron **(2 marks)**

(iv) State two properties of radioactive radiations giving a practical application each property **(4 marks)**

(b) Radioactive cadmium $^{108}_{48}Cd$ has a half-life of 607 hours

(i) Explain the meaning of the underlined phrase **(2 marks)**

(ii) Calculate the fraction of the cadmium nuclides left after 20.1 hours **(3 marks)**