JUNE 2000

SECTION A

ANSWER ONLY TWO QUESTIONS

1. (a) name two everyday situations of devices in which a couple is used. For each example identify the forces that constitute the couple, specifying the direction of each force on a diagram. (3 marks)

(b) Use the principle (or concepts) of physics to explain the following

(i) The weight of an object increase as we go from the equator to the poles (2 marks)

(ii) If a car initially at rest suddenly takes off the passengers jerk backwards (2 marks)

(c)

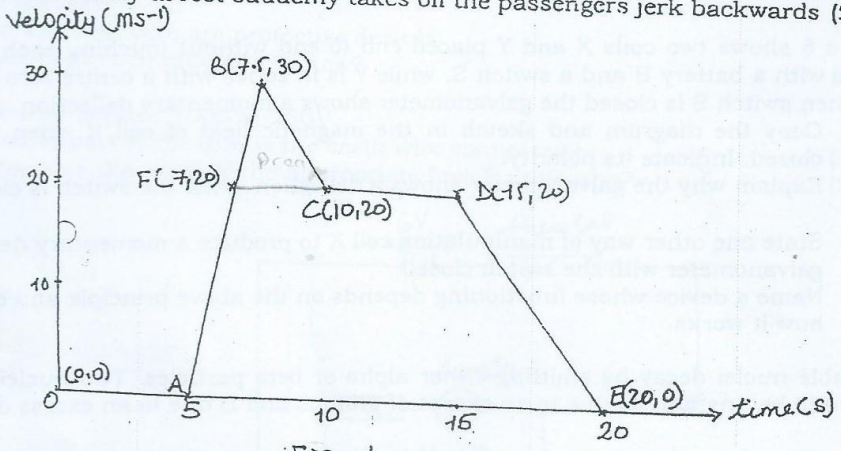

Fig. 1

The velocity/time graph above represents the journey made by a SONEL truck
Use the graph to determine.

(i) The total distance travelled by the truck (3 marks)

(ii) The average speed of the truck (2 marks)

(iii) The deceleration with which the truck was finally brought to rest (2 marks)

(iv) For the section CD of the graph determine the resultant force acting on the truck. Explain your answer. (3 marks)

2. (a) Describe an experiment using dynamics trolleys to verify the law of conservation of linear momentum

Your description should include

- The apparatus you would use and a diagram of the set up
- The procedure you would follow
- The measurements you would take
- How you would use your readings to obtain the results
- The precautions you would take to ensure accurate results.

(7 marks)

(b)

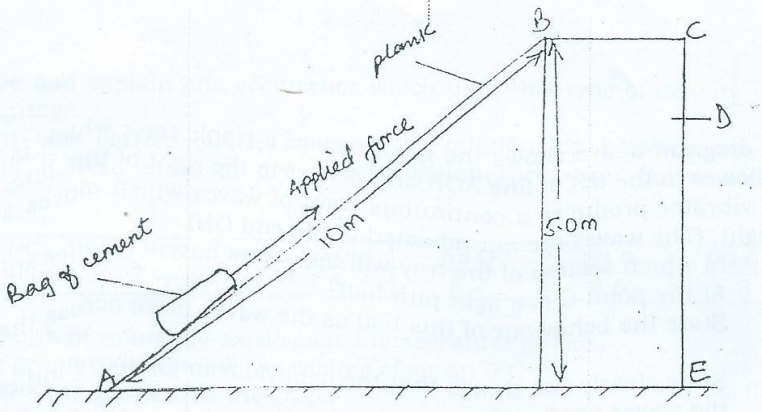

Fig. 2

A boy has to raise a bag of cement of mass 50kg from level AE onto the platform BC. H decides to pull the bag along an inclined plank AB at a uniform speed by applying constant force of 300N parallel to the plank

(i) Calculate the work he does in moving the bag from A to B (2 marks

(ii) Calculate the "useful" work he does when the bag reaches B. (2 marks

(iii) Calculate the efficiency of his arrangement (1 mark)

(iv) Name one factor responsible for his efficiency being less than 100% (1 mark)

When the bag reached BC. it was allowed to drop vertically downwards along th path CDE

(v) Describe the energy changes which take place between when the bag leaves C an when it hits E.

(2 marks

(vi) The point D is 3.2 m above E. calculate the speed with which the falling bag passe the point D. (2 marks

3. (a) For EACH of TWO NAMED electromagnetic waves (other than visible light) state

- Its approximate wavelength
- One instrument by which it can be detected
- One practical use to which it is put

(6 marks

(b)

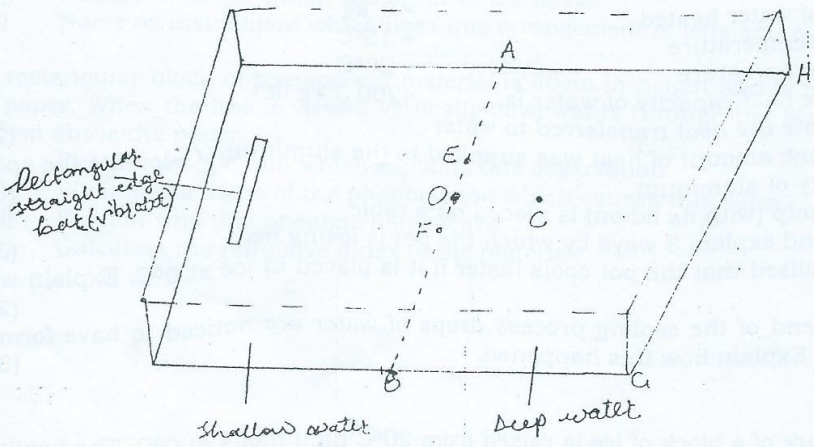

Fig. 3

The diagram above shows the glass tray of a ripple tank which is designed such that it is shallower to the left of line AOB and deeper to the right of this line.
The vibrator produces a continuous train of waves which moves across the tank from left to right. (The waves are not reheated at the end GH)

(i) In which section of the tray will the waves have a smaller speed? Explain **(2 marks)**

At the point C is a light pith ball

(ii) State the behaviour of this ball as the waves move across the water surface **(1 mark)**

(iii) State clearly two things that the behaviour in (ii) above indicates about the nature of the waves produced. **(2 marks)**

(c) A barrier is placed along the line AOB such that the only passage for the wave is a narrow gap EF

(i) Draw a diagram showing the wave patterns to the left and to the right of line AOB (when this barrier is in place). Your diagram should clearly indicate any change in the wavelength and shape of the wave after it crossed line AOB **(3 marks)**

(ii) What is the name of the effect caused by the small gap EF on the wave? **(1 mark)**

(iii) Name and explain one occurrence in nature which is due to this effect **(2 marks)**

SECTION B

ANSWER ONLY TWO QUESTIONS

4. (a) An experiment to measure the specific heat capacity of aluminum, uses an electric heater to heat an aluminum block. The heater is later used to heat water.

(i) What is meant by the term "specific heat capacity"? **(1 mark)**

(ii) Aluminum has a low specific heat capacity. Explain why this is useful in aluminum frying pans **(1 mark)**

(iii) Water has a high specific heat capacity. Explain why this is an advantage and a disadvantage at home **(2 marks)**

Here are some results of the experiment described above

Mass of Aluminum block	= 1kg
Initial temperature	= 15°C
Final temperature	= 39°C
Mass of water heated	= 1 kg
Initial temperature	= 15°C
Final temperature	= 20°C
Specific heat capacity of water is	4200 J $kg^{-1}k^{-1}$

(iv) Calculate the heat transferred to water **(2 marks)**

(v) The same amount of heat was supplied to the aluminum. Calculate the specific heat capacity of aluminum. **(3 marks)**

(b) A pot of hot soup (with its lid on) is placed on a table

(i) State and explain 3 ways by which the pot is losing heat **(3 marks)**

(ii) It is realised that the pot cools faster if it is placed in ice at 0°C. Explain why this is so. **(2 marks)**

(iii) At the end of the cooling process drops of water are noticed to have formed under the lid. Explain how this happened. **(3 marks)**

5. (a) The temperature of a block of ice is raised from 20°C till it melts at 0°C. The heating is continued so that the temperature of the water rises to 10°C

(i) Sketch a graph of density (y-axis) versus temperature (x-axis) to show how the density of water and ice vary over the range-20°C to 10°C. **(3 marks)**

(ii) Describe and explain one occurrence which uses this type of density variation to disadvantage (4 marks)

(b) An experiment was carried out to examine the relationship between the volume an temperature of a fixed mass of dry air at constant pressure. Below are the result obtained.

Temperature (^{0}C)	15.0	40.0	65.0	80.0	90.0
Volume (m^3) X 10^{-6}	7.0	7.6	8.2	8.6	8.8

(i) Plot a graph of volume (y-axis) against temperature (x-axis) (3 marks)
(ii) Use the graph to determine the volume of air at) 0^{0}C (2 marks)
(iii) Determine the gradient of the graph (2 marks)
(iv) Explain the significance of your answer in (iii) above (1 mark)
(v) State (in ^{0}C) the lowest temperature to which the air could have been cooled in thi experiment (1 mark)
(vi) What would be the nature of the behaviour of the air molecule at this temperature? (1 mark)

6. (a) An object 5cm tall is placed erect and 10cm infront of a plane mirror. An observer sees th full image of the object in the mirror when looking along a sighting line which makes an angle of 40 with the normal at the mirror surface.

Draw a labelled ray diagram which shows clearly how the observer sees the head and foo of the image. Your diagram should have at least four incident rays (two from the head and two from the foot) and should indicate some important angles, distances and heights (4 marks)

(b) An object 10cm tall is placed 20cm infront of a convex lens. It is observed that the imag produced has the same size as the object.

(i) What is the value of the focal length of this lens? Explain how you arrived at you answer (2 marks)
(ii) State 3 other properties of this image (1 mark)
(iii) Name an instrument which is an application of such an arrangement of lens an object distance (1 mark)

The object is now placed 25cm from the lens

(iv) Name 3 changes which will occur to the image (1 mark)
(v) Name as instrument which uses this arrangement of lens and object distance (1 mark)

(c) A rectangular block of transparent material is 40cm in height and is placed over a line o a paper. When the line is viewed vertically downwards through the block, it appears to b 15cm above the paper

(i) Draw a ray diagram which explains this observation
(ii) What is the name of the phenomenon which causes this effect? (1 mark)
(iii) Explain why this phenomenon occurs (2 marks)
(iv) Calculate the refractive index of the material (2 marks)

SECTION C

ANSWER ONLY TWO QUESTIONS

7. (a) (i) Name a substance which, when rubbed with cloth, will become positively charged **(1 mark)**

(ii) Explain clearly how and why it becomes positively charged **(2 marks)**

(b) The potential of a cloud is 10^9V and it discharged 200C of electricity in 2×10^{-4}s. Calculate

(i) The energy carried in the discharge **(2 marks)**

(ii) The power of the discharge **(2 marks)**

(iii) The current flowing during the discharge **(2 marks)**

The lightning flash that accompanied this discharge struck a house, which a few seconds later started burning.

(iv) Explain the origin of the heat that caused the house to burn **(2 marks)**

(c) An electrician has to wire three fused sockets in the walls of a room

(i) Draw a diagram of the ring circuit he will use. In your diagram

- Indicate the wiring of the switch and fuse for one socket
- Write the names of the 3 wires usually found in such a circuit **(3 marks)**

(ii) In such a connection, the electrician has to ensure that there is good electrical contact and good earthing contact. Explain why each is important. **(3 marks)**

8. (a)

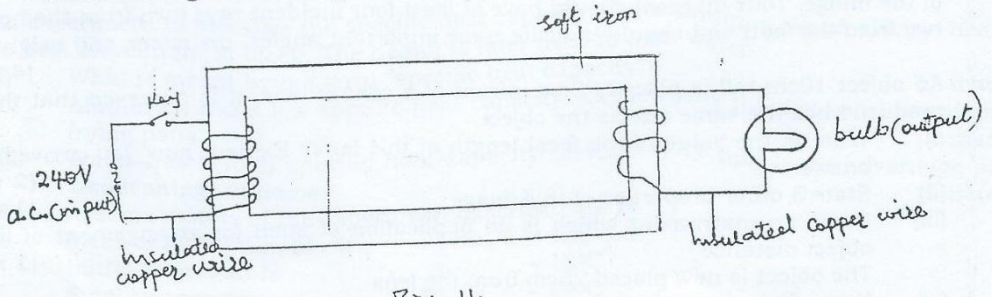

Fig 4

The diagram above shows the structure of a transformer

(i) There is no direct electrical connection between the two coils, but when the key is closed, the bulb lights.
Explain clearly why this happens **(2 marks)**

In the practical situation the efficiency of a transformer is less than 100%

(ii) State and explain two reasons responsible for this and explain how each brings about the decrease in efficiency **(4 marks)**

(iii) For each of the 2 reasons you have given in (ii) above name a specific feature of the transformer's design which decreases its effect. **(2 marks)**

(b) A simple compass has a freely pivoted permanent magnetic needle
In what direction will the needle always settle. Explain **(3 marks)**

(c)

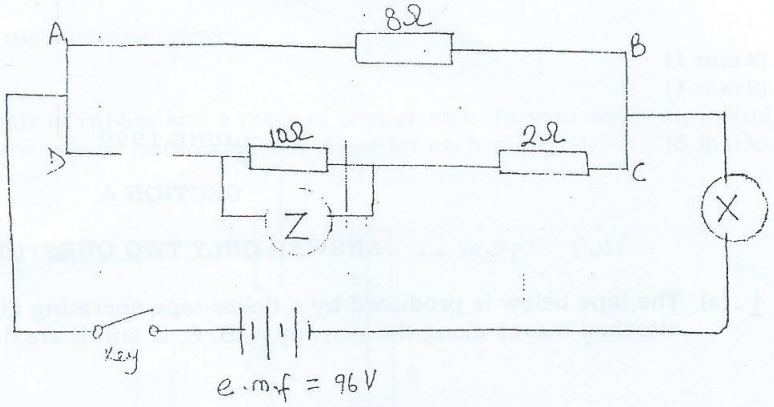

Fig. 5.

In the circuit diagram shown above, the battery has negligible internal resistance and th meters X, Y and Z are assumed to have their normal properties. When the key is closed calculate

(i) The reading of meter X (2 marks)
(ii) The reading of meter Y (2 marks)
(iii) The reading of meter Z (2 marks)

9. (a) Compare the fundamental constituents of an atom in terms of
(i) Their names
(ii) Their positions in the atom
(iii) Their relative masses (compared to the mass of a chosen particle
(iv) Their relative charges
(v) Their effect on the electrical nature of a normal atom
(vi) The effect of their numbers on the stability of the atom

(7 marks)

(b) A radioactive preparation emitting all three radiations is placed in a magnetic field so tha the radiations are moving perpendicularly to the magnetic field
Draw a diagram to show the behaviour of each radiation in the magnetic field and identif each radiation with reason. (4 marks)

(c) A student took readings of the background count at intervals on one minute. Here are hi results

Counts / minute	28	15	23	16	20	26	11
Time (minutes)	1	2	3	4	5	6	7

(i) Name the instruments he used in his measurement (1 mark)
(ii) Explain the underlined phrase and state two sources of it (3 marks)
(iii) Why are the figures not following any particular pattern? (2 marks)