DIRECTORATE FOR QUALITY AND STANDARDS IN EDUCATION
Department for Curriculum Management and eLearning
Educational Assessment Unit
Annual Examinations for Secondary Schools 2011

FORM 3 **PHYSICS** **TIME: 1h 30min**

Name: _____ **Class: _____**

Answer all questions.
All working must be shown. The use of a calculator is allowed.
Where necessary take acceleration due to gravity g = 10m/s^2.

You may find some of these equations useful:

Energy and Work	W = Fs PE = mgh	E (or W) = Pt KE = ½ mv^2
Weight Moments	W = mg M = Fs	
Density Pressure	ρ = m/V P = F/A	 P = hρg
Heat	ΔQ = mcΔθ	

For office use only:

Question No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Theory**	**Practical Mark**	**Final Mark**
Max. Mark	**8**	**8**	**8**	**8**	**8**	**15**	**15**	**15**	**85**	**15**	**100**
Score											

SECTION A: This section carries a total of 40 marks.

1. (a) Object A of density **0.95 g/cm^3** and object B of density **0.43 g/cm^3** as shown in **Diag** below are placed in a tank full of water of density **1 g/cm^3**.

Diagram 1

Underline the correct answer in each case:

- Object A will ***float / sink*** in water.
- Object B will ***float / sink*** in water. (2)

(b) The tank is emptied and another **liquid X** of density **0.80 g/cm^3** is poured in. The same objects A and B are placed in the tank again.

Diagram 2

Underline the correct answer in each case:

- Object A will ***float / sink*** in liquid X.
- Object B will ***float / sink*** in liquid X. (2)

(c) Liquid X (density 0.8g/cm^3), liquid Y (density 0.9g/cm^3) and water (density 1.0g/cm^3) were poured into a measuring cylinder as shown **Diagram 3** below. Label the liquids to show their position in the measuring cylinder below.

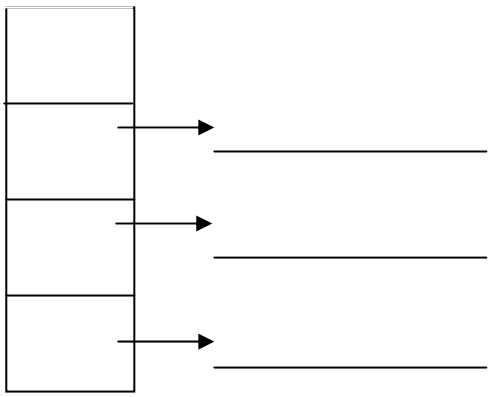


Diagram 3

(2)

(d) Briefly describe how a student measures the **<u>mass</u>** of a liquid in a school laboratory.

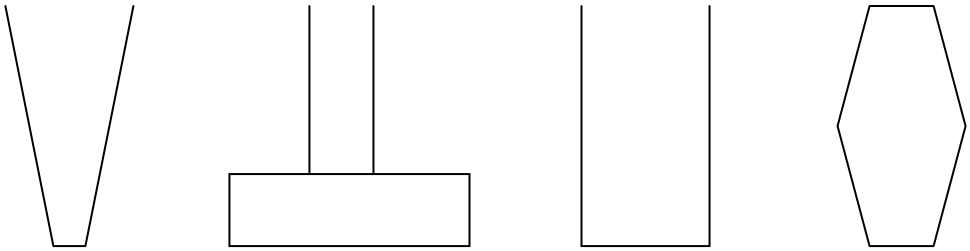
_____

_____

_____

(2)

2. Some homes have a wooden floor. Heavy furniture sometimes marks the wood[illegible] which they stand. **Diagram 4** below represents four different shapes of furniture l[illegible] C and D.



A **B** **C** **D**

Diagram 4

(a) Which furniture leg shape A, B, C or D is most likely to mark the floor underneath?

_____

(1)

(b) Explain your answer.

_____

(1)

(c) One of the legs of a dining room table is shown in **Diagram 5**. Calculate the:

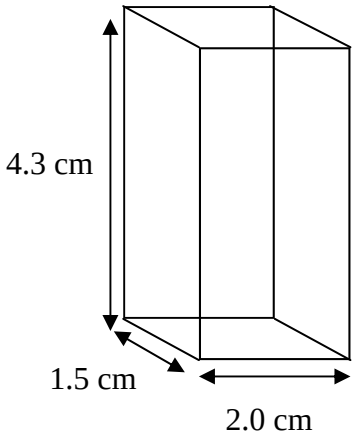


Diagram 5

i. **contact area** with the ground.

_____ (2)

ii. contact area of all **four** legs.

_____ (1)

(d) The weight of the table is 600 N. Calculate the **pressure** the table exerts on the floor.

_____

_____

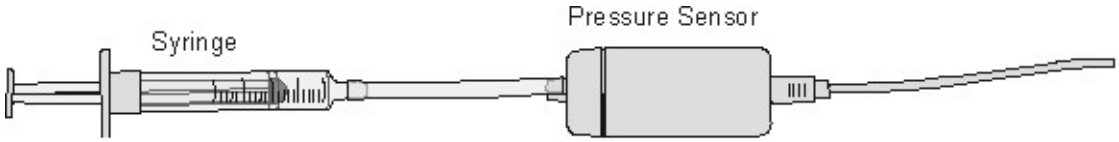
(2)

(e) The table is replaced with a heavier one with legs of **same base area.** State what happens to the size of the pressure that the table now exerts on the wooden floor.

_____

(1)

3.(a) Catherine uses a 20 cm^3 syringe and a pressure sensor attached to a data logger to understand the relationship between the **volume** of a fixed mass of gas and the **pressure** it creates.



These are some of Catherine's results:

Pressure / kPa	42	52	70
Volume / cm^3	10	8	6

(i) Use the above diagram to explain how Catherine changes the **volume** reading.

_____

(1)

(ii) What happens to the pressure of the gas in the syringe as the volume gets smaller?

_____

(1)

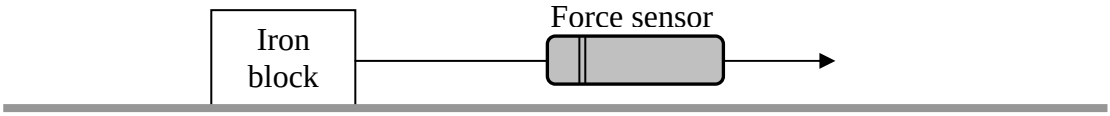
(iii) Underline the correct word in each of the following.

As the volume of the gas in the syringe gets smaller the:

- molecules (particles) collide ***more \ less*** frequently.
- speed of the molecules (particles) ***increases \ decreases \ remains the same***.

(2)

(b) Catherine then attaches an iron block to a force sensor connected to a data logger. She pulls the iron block with a force of 15 N over a distance of 2.5 m in 12 s.



(i) Calculate the work done to move the iron block.

_____

_____

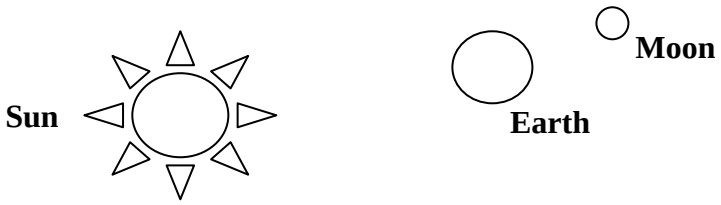
(2)

(ii) Calculate the power exerted by Catherine while pulling the iron block.

_____

(2)

4. (a) On **Diagram 6** below draw the **orbits** of the **Moon** and **Earth.** (The diagram is [illegible])



(2)

Diagram 6

(b) How long does the Earth take to complete one orbit?

_____

(1)

(c) Name the **force** that causes the movement of the Moon and Earth.

_____

(1)

(d) John has a **mass** of 54 kg. Calculate his **weight** on Earth.

_____

(2)

(e) Compare John's **weight** on the Earth and on the Moon. Explain why it is different.

_____

(2)

5.(a) Complete the following:

Hooke's law states that the _____ applied to a spring is directly proportional to the _____ of the spring, provided that the _____ limit of the spring is not exceeded. (3)

(b) John and Jacob use a spring, a ruler, a set of weights and a pointer in the school laboratory to verify Hooke's law. In the space below draw the apparatus used for the experiment.

(3)

(c) From the following, underline any **<u>two</u>** correct precautions for Hooke's Law's experiment.

- Taking ruler readings at eye level.
- Adding weights until the spring is deformed.
- Taking repeated readings from the ruler.
- Students taking turns to take a reading.
- Placing the ruler exactly vertical next to the spring. (2)

SECTION B: This section carries a total of 45 marks.

6. This question is about heat energy.

(a) (i) Energy flows from a human hand to the surroundings at a rate of 1.5 W. Calculate the quantity of heat energy flowing from the hand to the room in 3 minutes.

_____

_____

(2)

(ii) Heat energy from a human hand is mainly transferred by two processes. Complete **Diagram 7** below by entering the names of these three processes.

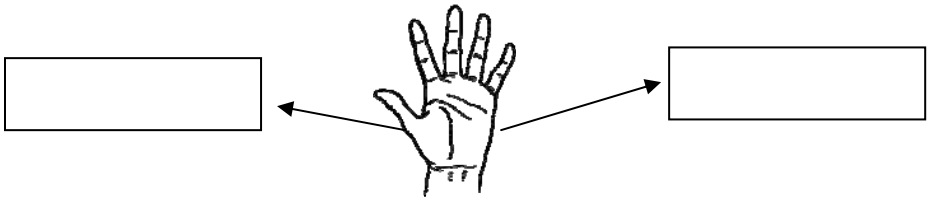
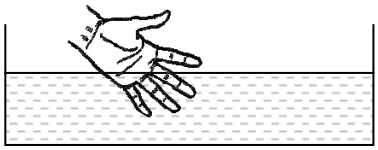


Diagram 7

(2)

(iii) Joseph lowers his hand in water at **room temperature.** The water feels colder than the air at the **same temperature**. Explain why.



_____

(1)

(b) **Diagram 8** shows a solar panel unit.

(i) Explain briefly how water is heated by the solar panel.

_____

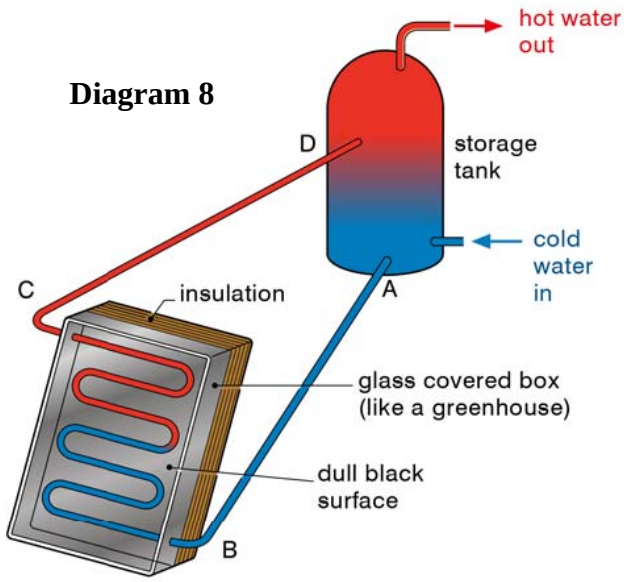
_____

_____

_____

(2)

Diagram 8



(ii) The pipe in the solar collector is curved as shown in **Diagram 9.** Why is the pipe curved?

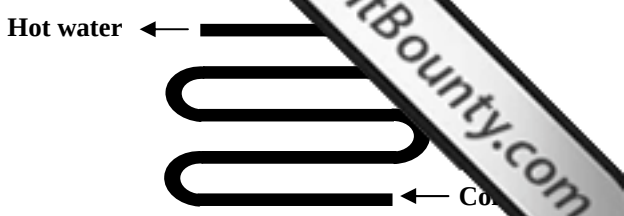


Diagram 9

_____

_____

(1)

(iii) Explain why the pipe:

- is made of copper:_____

_____

(1)

- is painted black: _____

_____

(1)

(c) The storage tank holds up to 80 kg of water. The specific heat capacity of water is 4200J/kg^{o}C.

(i) Calculate the quantity of energy needed to raise the temperature of the water in the tank from 25 ^{o}C to 40 ^{o}C.

_____

_____

(3)

(ii) The power of the electric heater is 2000 W. How long will it take to heat up all the water in the tank using only the electric heater?

_____

_____

(2)

7. This question is about the moment of a force and energy.

Diagram 10 represents the forces acting on a fishing rod of negligible weight when Leanne catches a fish.

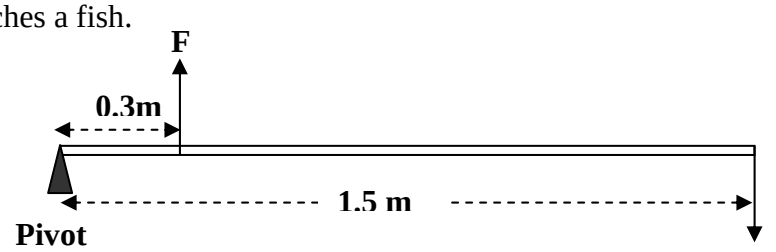


Diagram 10

(a) (i) In the above diagram, F represents the force exerted by the girl. What does the 5 N force represent?

_____

(1)

(ii) Calculate the clockwise moment about the pivot.

_____

_____

(2)

(iii) State the value of the anticlockwise moment assuming that the fishing rod is balanced.

_____

(1)

(iv) State the principle of moments.

_____

_____

(2)

(v) Using the principle of moments, calculate the value of the force **F**.

_____

_____

(2)

(b) At a height of **1.2 m** above **sea level**, the fish falls back to the water.

(i) What type of energy does the fish have when it is at its maximum height?

_____

(1)

(ii) Calculate the energy of the fish when it is at its maximum height.

_____

_____

(3)

(iii) Assuming no energy losses, what is the amount of energy of the fish just before it hits the surface of the water?

_____

(2)

(iv) State the **law** you used for your answer in b(iii) above.

_____

(1)

8. This question is about pressure

(a) A force of **60 N** is applied on a small piston of a hydraulic jack of area **0.3 m^2** as shown in **Diagram 11**. The area of the larger piston is **3 m^2**.

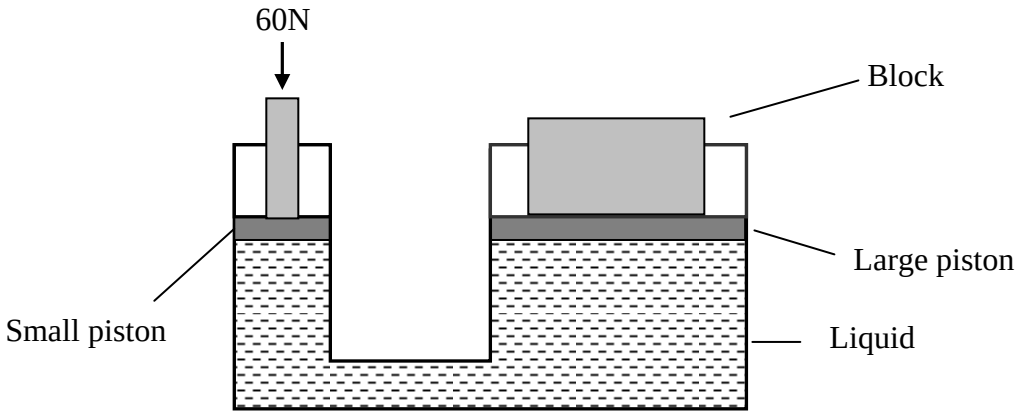


Diagram 11

(i) What liquid is used in a hydraulic jack?

_____

(1)

(ii) Name **<u>one</u>** property of the liquid used in a hydraulic jack.

_____

(1)

(iii) Calculate the pressure exerted by the force of 60 N at the **small** piston.

_____

_____

(2)

(iv) Assuming no energy losses, calculate the force exerted on the **large** piston.

_____

_____

(2)

(v) Using your answer in a(iv), what is the mass of the block?

_____

(1)

(b) In 1662, the chemist and physicist Robert Boyle published a law on **pressure and volume**.

In an experiment to verify the relationship between pressure and volume, the following results were obtained.

Pressure / kPa	100	200	250	400	500
Volume / cm^3	10	5	4	2.5	2
1/Volume / cm^{-3}	0.10				

(i) **Fill in** the missing values in the above table (*work out values in last row*).

(2)

(ii) Plot a graph of **Pressure** on the **y-axis** against **1/Volume** on the **x-axis**.

(4)

(iii) Is the graph showing a **linear relationship** between the values you plotted in b(ii) above? Explain.

_____

_____

(2)