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

Tra

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 = $10 m/s^2$.

You may find some of these equations useful:

Energy and Work	$W = Fs$ $PE = mgh$	E (or W) $= Pt$ $KE = \frac{1}{2} mv^2$
Weight Moments	$W = mg$ $M = Fs$	
Density Pressure	$\rho = m/V$ $P = F/A$	$P = h\rho g$
Heat	$\Delta Q = mc\Delta\theta$	

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.

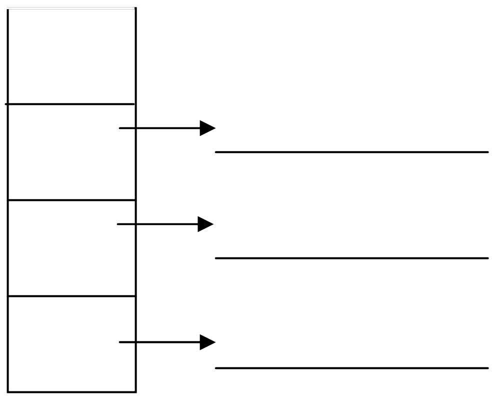


Diagram 3

(2)

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

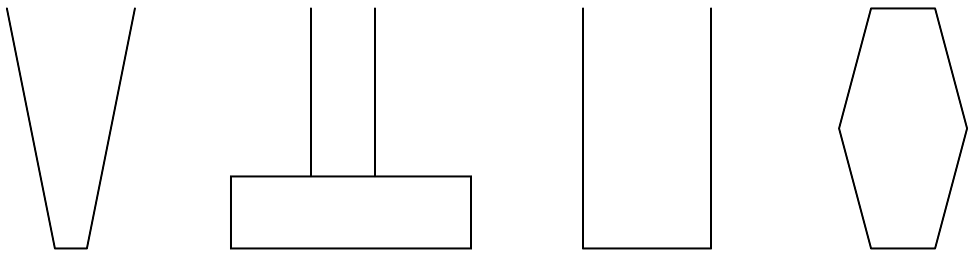
____

____

____

(2)

2. Some homes have a wooden floor. Heavy furniture sometimes marks the woo[...] which they stand. **Diagram 4** below represents four different shapes of furniture [...] 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:

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

______________________________ (2)

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

______________________________ (1)

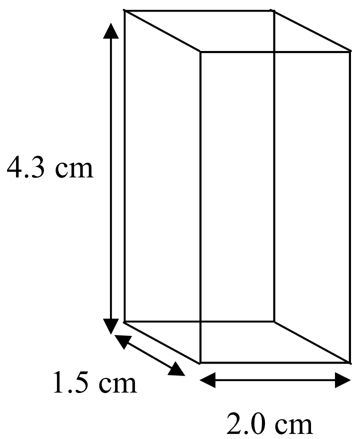


Diagram 5

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

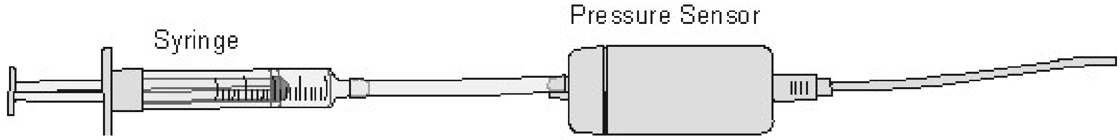
____

____ (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 da… understand the relationship between the **volume** of a fixed mass of gas and the **p…** 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)

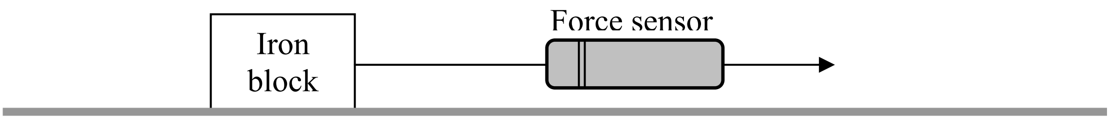
(iii) Underline the correct word in each of the following.

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.



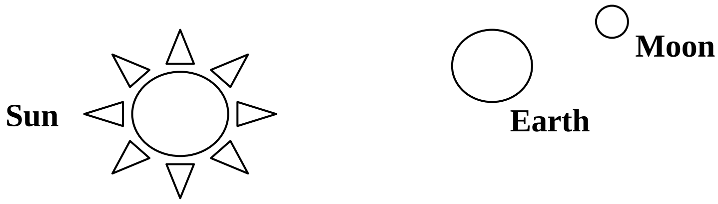
(i) Calculate the work done to move the iron block.

(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



(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 **two** 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 a room at a rate of 1.5 W. Calculate the quantity of heat energy flowing from the hand to the room in 180 s.

____

____

(2)

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

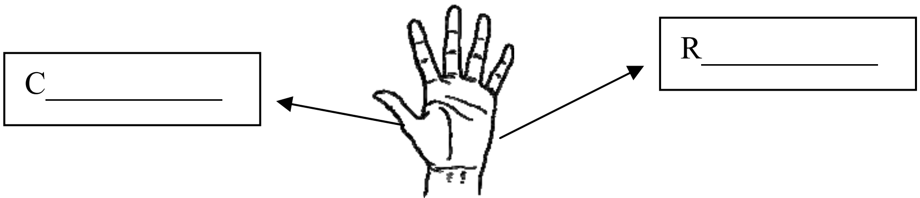
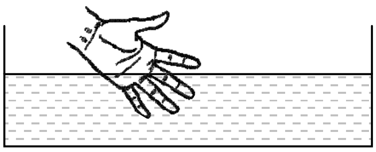


Diagram 7

(2)

(iii) Joseph lowers his hand in water at **room temperature.**



Complete:
The water feels colder as it is a better ____________________ of heat than air.

(1)

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

(i) Fill in the missing spaces with one of the words below:

reflect, absorb, tank, solar, wind.

The glass solar panel traps the __________ energy.

The black copper pipes __________ the heat energy

which warms the water. The water is stored in the

__________. (3)

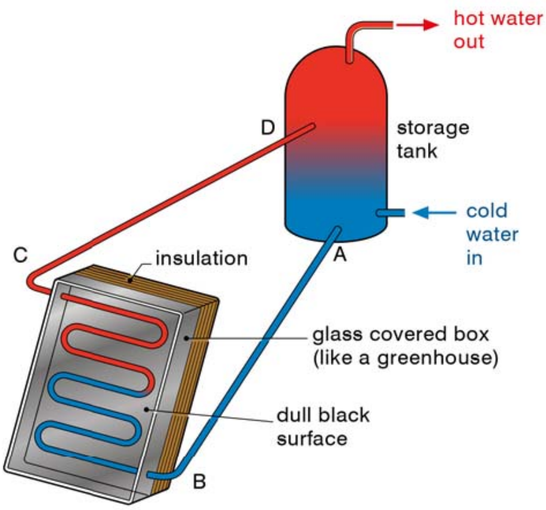


Diagram 8

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

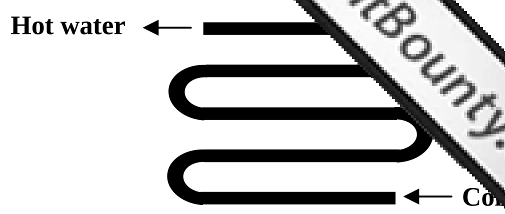


Diagram 9

____

____

(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. The water in the tank is heated from 25 ^{o}C to 40 ^{o}C.

(i) Calculate the rise in temperature of the water in the tank.

____

(1)

(ii) Using the formula $\Delta Q = mc\Delta\theta$ calculate the quantity of energy required to raise the temperature of the water from 25 ^{o}C to 40 ^{o}C.

____

____

(2)

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

____

____

(1)

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.

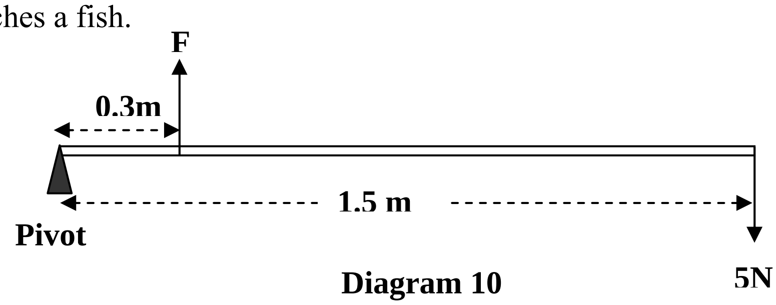


Diagram 10

(a) (i) In **Diagram 10**, F represents the force exerted by the girl. What does the 5 N force represent?

____ (1)

(ii) On **Diagram 10** above, draw **two** arrows to show the direction of the clockwise moment and the anticlockwise moment. (2)

(iii) Calculate the clockwise moment of the fish about the pivot.

____

____ (2)

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

____ (1)

(v) Complete the following statement:

The **Principle of Moments** states that when an object is in equilibrium, the total clockwise moments ____. (1)

(vi) Use this principle to calculate a value for force **F**.

____

____ (2)

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

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

(1)

(ii) The weight of the fish is 5 N. Calculate the mass of the fish.

(1)

(iii) Calculate the amount of energy gained by the fish at this height. ($g = 10m/s^2$)

(2)

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

(1)

(v) Which law did you use to answer part b(iv) 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**.

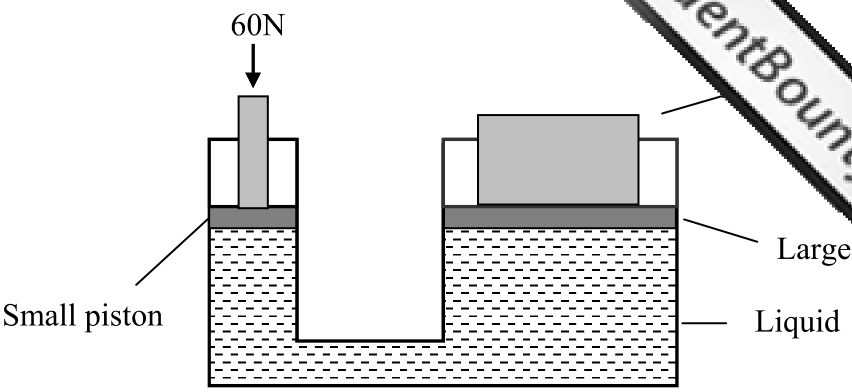


Diagram 11

(i) Which liquid is normally used in a hydraulic jack? ______________ (1)

(ii) Name **one** property of liquid used in a hydraulic jack.

____ (1)

(iii) Using the formula $P = \frac{F}{A}$, calculate the pressure exerted by the 60 N force at the **small** piston.

____

____ (2)

(iv) What is the pressure exerted on the large piston?

____ (1)

(v) Using your answer in a(iv), calculate the force exerted on the block.

____ (2)

(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 (1/cm^3)	0.10	0.20	0.25	0.40	0.5

(i) Plot a graph of **Pressure** on the y-axis against **1/Volume** on the x-axis. (5)

(ii) From your graph or otherwise, what is the value of:

- the pressure when 1/Volume is 0.15 cm^{-3}? (1)

- the volume when the Pressure is 50 kPa?