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

Track 2

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 **Diagram 1** 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.

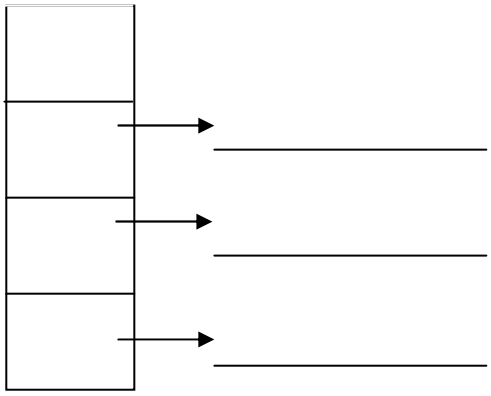


Diagram 3

(2)

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

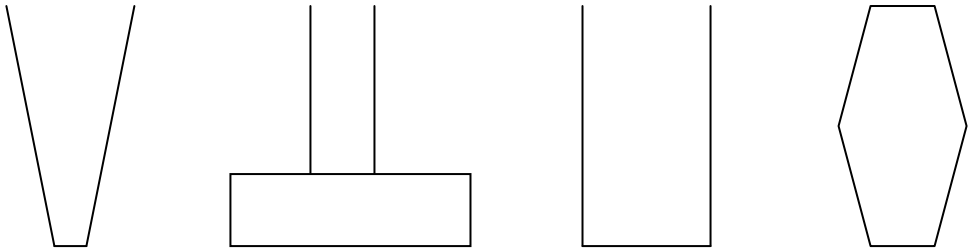
_____

_____

_____

(2)

2. Some homes have a wooden floor. Heavy furniture sometimes marks the wooden floor on which they stand. **Diagram 4** below represents four different shapes of furniture legs A, B, 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 dinning room table is shown in **Diagram 5**. Calculate the:

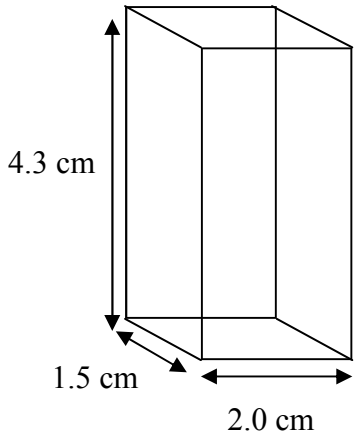


Diagram 5

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.

_____

_____

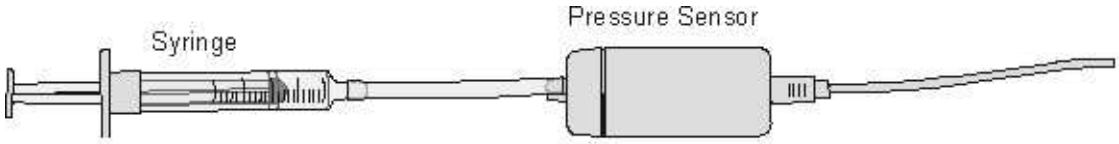
(2)

(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)

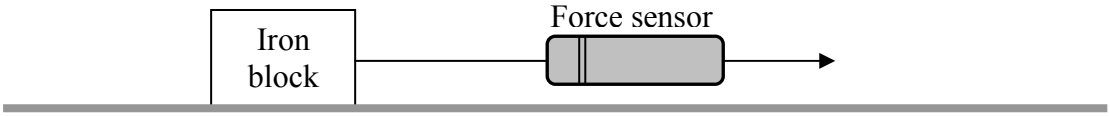
(iii) Underline the correct word in each of the following.

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.

_____

_____

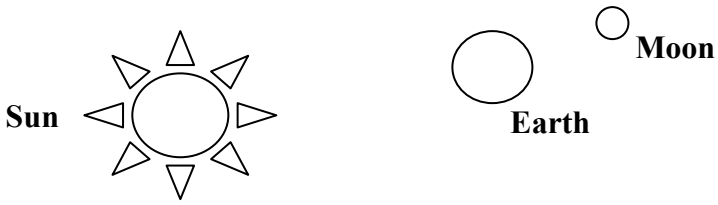
(2)

(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 not to scale)



(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 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.

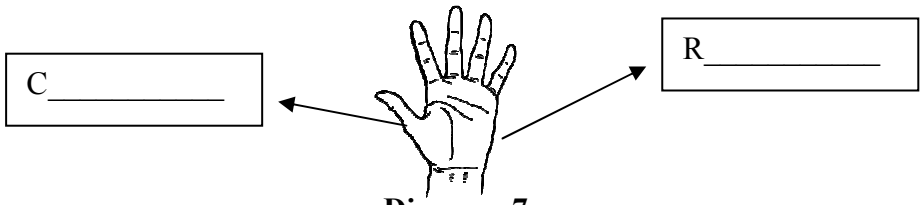
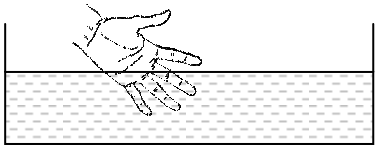


Diagram 7

(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)

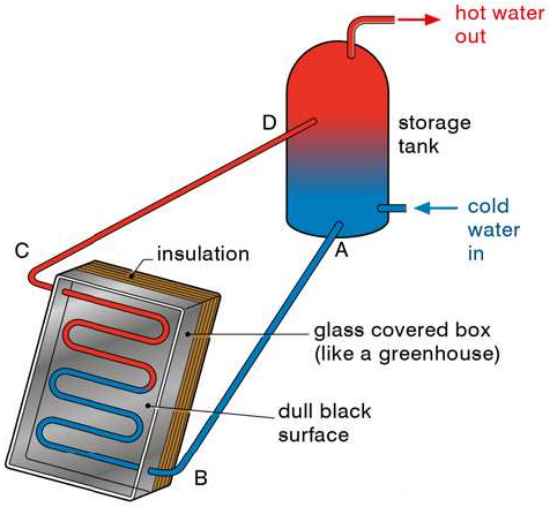


Diagram 8

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

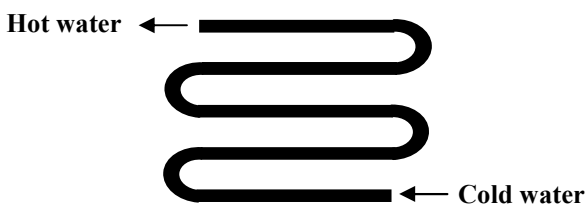


Diagram 9

_____

_____

(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.

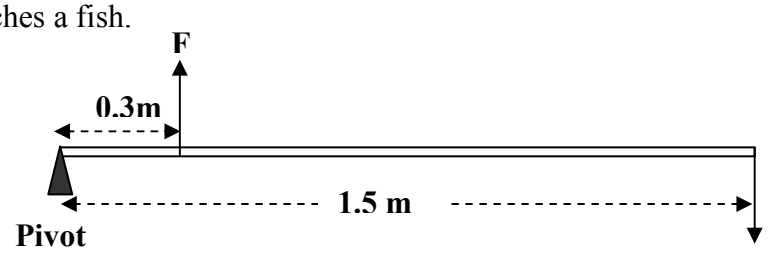


Diagram 10

(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 **<u>two</u>** 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. ($g = 10 m/s^2$)

_____

_____

(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**.

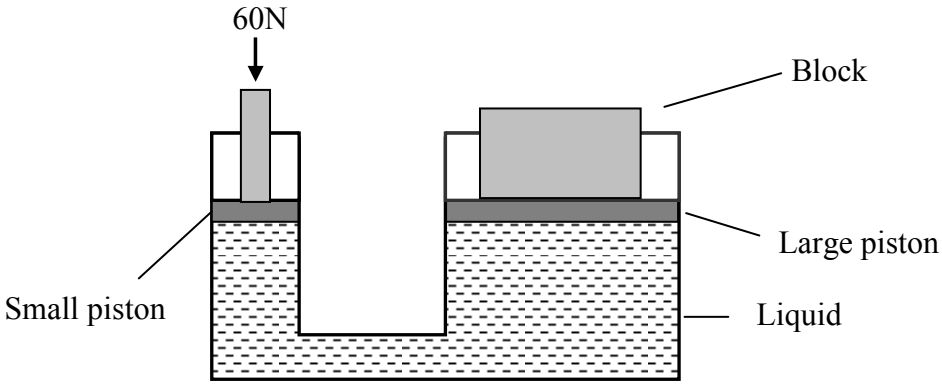


Diagram 11

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

(1)

(ii) Name **<u>one</u>** 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? (2)