Name:		Index Number:		Class:	

CATHOLIC HIGH SCHOOL
Term 2 Class Test
Year 4 (Integrated Programme)

Non-common questions with Sec.4 TA2:
All MCQs &
Q.3 (Thermal Properties)

PHYSICS

1. Physical Quantities, Units and Measurement
2. Kinematics
3. Dynamics
4. Mass, Weight and Density
5. Thermal Properties of Matter
6. Static Electricity
7. Current of Electricity
8. D.C. Circuits
9. Practical Electricity
10. Practical (Planning Skills)

3 May 2023
40 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black link.
You may use a HB pencil for any diagrams or graphs.
Do not use paper clips, glue or correction fluid.

Section A: Multiple Choice
There are **ten** questions in this section. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice **in the table** provided at the start of this section.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

Section B: Structured
You may use an HB pencil for any diagrams or graphs.

Answer **all** questions.

Candidates are reminded that **all** quantitative answers should include appropriate units.
The use of an approved scientific calculator is expected, where appropriate.
Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

The number of marks is given in brackets [ ] at the end of each question or part question.

For examiner's use only:

Section A	/ 10
Section B	/ 25
formula s.f.	☐ ☐
Total	**/ 35**

Section A

Answer **all** the questions in this section.
Record your choice **in the table** provided below.

1		**2**		**3**		**4**		**5**	
6		**7**		**8**		**9**		**10**	

1 An object falls from rest through the air and the air resistance acting on it increases. The object reaches terminal velocity after some time.

Which quantity decreases until its terminal velocity is reached?

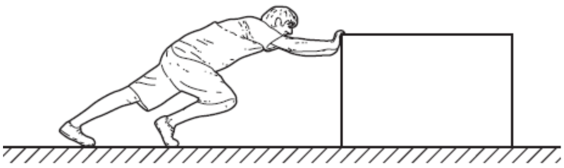
A acceleration
B gravitational field strength
C kinetic energy
D weight

2 A hard stone hits the ground and comes to rest almost immediately.

As the stone hits the ground, what is the direction and the size of the force acting on the ground?

A downwards and equal to the weight of the stone
B downwards and larger than the weight of the stone
C upwards and equal to the weight of the stone
D upwards and larger than the weight of the stone

3 A man pushes a heavy box along the ground.



A force acts between the man's hands and the box.

Another force acts between the man's feet and the floor.

In which direction do these forces act on the man?

	force on man's hands	force on man's feet
A	towards the left	towards the left
B	towards the left	towards the right
C	towards the right	towards the left
D	towards the right	towards the right

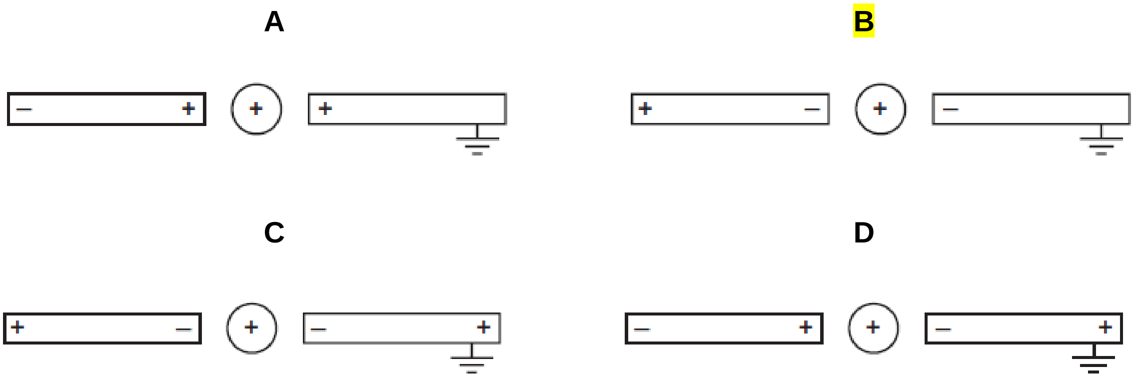
4 Four objects are situated in places with different gravitational field strengths.

Which object has the greatest weight?

	mass / kg	gravitational field strength / N / kg
A	3.0	10.4
B	3.5	9.5
C	4.0	10.2
D	4.5	9.0

5 A positively charged metal sphere is placed midway between two previously uncharged metal rods, one of which is connected to earth.

Which diagram shows the charges on the rods?



Nov 2016 (5054)

6 A piece of wire has a resistance of 16 Ω.

Another wire made from the same metal has four times the length and twice the cross-sectional area.

What is the resistance of the wire?

A 8 Ω **B** 32 Ω **C** 96 Ω **D** 128 Ω

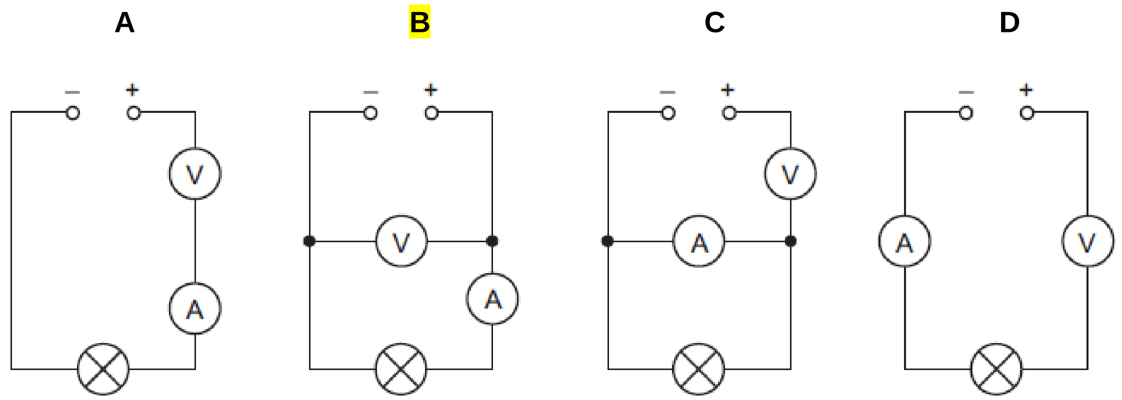
7 Three identical cells are connected in parallel to a resistor.

What is the advantage of using three cells in parallel, rather than using a single cell?

A Each cell produces more energy.
B Each cell supplies more charge.
C Each cell takes longer to deplete.
D The total electromotive force (e.m.f.) is larger.

8 In a circuit, a voltmeter is used to measure the potential difference across a lamp. An ammeter is used to measure the current in the lamp.

Which diagram shows the circuit?



9 An electrical appliance is plugged into a socket in the wall using an electrical cable. The plug contains a fuse.

What is the main purpose of the fuse?

A to earth the appliance
B to earth the plug
C to protect the user from electric shock
D to protect the electrical cable from overheating

10 One kilowatt-hour of energy costs \$0.24.

How much does it cost to run a 200 W heater for 180 minutes?

A \$0.02 **B** \$0.05 **C** \$0.07 **D** \$0.14

Section B

Answer **all** the questions in this section.

1 A microphone has a weight W of 6.0 N. It is suspended by wire X from the ceiling in a radio studio.

Fig. 1.1 shows the microphone held in a stationary position by a wire Y.

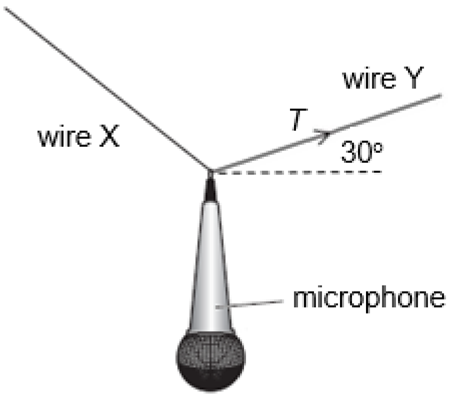


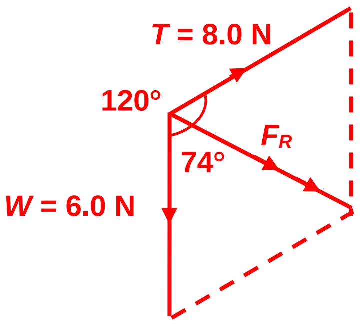
Fig. 1.1

The tension T in wire Y is 8.0 N.

Using a scale diagram, determine the magnitude and the direction of the resultant of W and T.

- **vector diagram** **B1**
  - **arrow heads and directions**
  - **dotted lines (for parallelogram method only)**
- **correct scale** **B1**
  - **at least 2 cm : 1 N**
- **F_R ≈ 7.2 N (± 0.1 cm)** **B1**
- **Angle to vertical ≈ 35° (± 1°)** **B1**

Scale 2 cm : 1 N



magnitude = ...

direction = ...
[4]

2 A parachutist jumps from an aircraft. Some time later, the parachute opens.

Fig. 2.1 is a graph of the vertical speed of the parachutist plotted against time *t*.

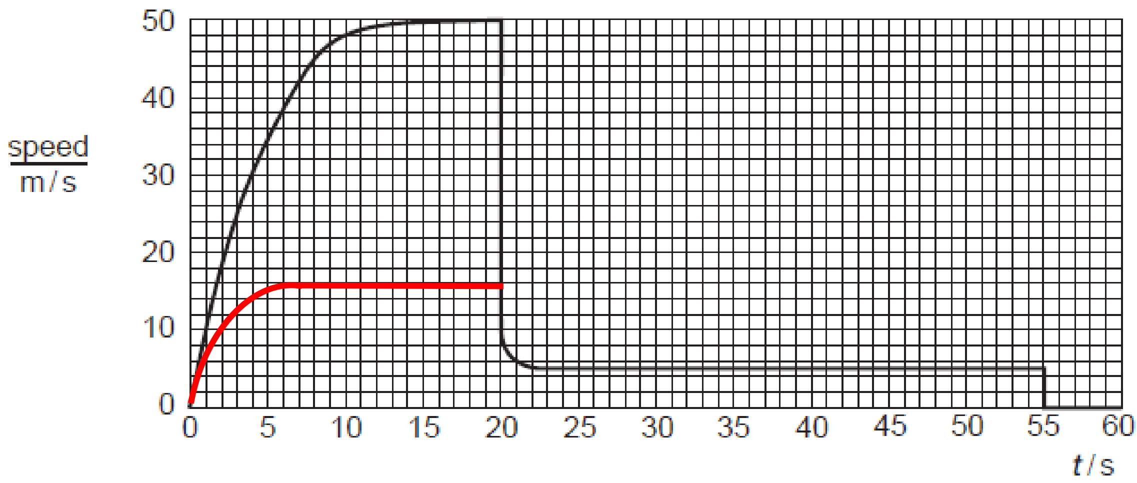


Fig. 2.1

(a) Describe the motion of the parachutist between t = 0 and t = 20 s.

Parachutist accelerates / Speed increases **B1**

Acceleration decreases (to 0) / Speed becomes constant **B1**

[2]

(b) A second parachutist, of **smaller** mass, falls out of the aircraft at the same time as the parachutist, using the same parachute.

On Fig. 2.1, using the same axes, sketch the speed-time graph of the second parachutist as it falls, **until *t* = 20 s**.

- Lower speed (at all times) [1]

- Reaches (or will not reach) lower terminal velocity earlier – B1

3 Water at a temperature of 16 °C enters an ice-making machine and emerges as ice cubes at a temperature of –5 °C. The melting point of ice is 0 °C.

The following data are provided:

- specific heat capacity of liquid water = 4.2×10^3 J / (kg °C)
- specific latent heat of fusion of water = 3.4×10^5 J / kg
- specific heat capacity of ice = 2.1×10^3 J / (kg °C)

(a) State the difference between *specific heat capacity* and *specific latent heat of fusion*.

Specific heat capacity: The amount of thermal energy required to raise the temperature of 1 kg (or: unit mass) of the material by 1 K or 1 °C. **B1**

Specific latent heat of fusion: The amount of thermal energy required in changing 1 kg (or: unit mass) of substance from a solid into a liquid state (or vice versa), without a change in temperature. **B1**

[2]

(b) Calculate the total energy removed from 2.0 kg of water at 16 °C as it changes into ice at –5 °C.

$Q = (mc\Delta\theta)_{water} + ml + (mc\Delta\theta)_{ice}$

$= (2.0)(4.2 \times 10^3)(16 - 0)$ **B2**

$+ (2.0)(3.4 \times 10^5)$

$+ (2.0)(2.1 \times 10^3)[0 - (-5)]$

= 134 400 + 680 000 + 21 000

= 835 400

= $\underline{8.4 \times 10^5 \text{ J}}$ (2 s.f.) **B1**

energy = ... [3]

4 A hockey player trains on a nylon-fibre surface. As he runs around, his shoes rub against the surface, and he becomes positively charged.

(a) Explain, in terms of the charges involved, how he becomes positively charged.

He loses electrons to the surface. **B1**

He has excess positive charges. **B1**

[2]

(b) At the end of the training session, the hockey player touches a metal gate and feels an electric shock.

(i) Explain how this shock is produced.

He gains electrons from the metal gate. **B1**

[1]

(ii) The shock lasts for 0.15 ms. During this time, the current has an average value of 1.6 mA.

Calculate the amount of charge on the hockey player just before he touches the gate.

$I = Q \div t$

$Q = It$

$= (1.6 \times 10^{-3})(0.15 \times 10^{-3})$ **B1**

$= \underline{2.4 \times 10^{-7}\ C}$ (2 s.f.) **B1**

charge = ... [2]

5 Fig. 5.1 shows a resistance wire XY used as a potentiometer circuit by a student. The total resistance of the resistance wire XY is 4.8 kΩ.

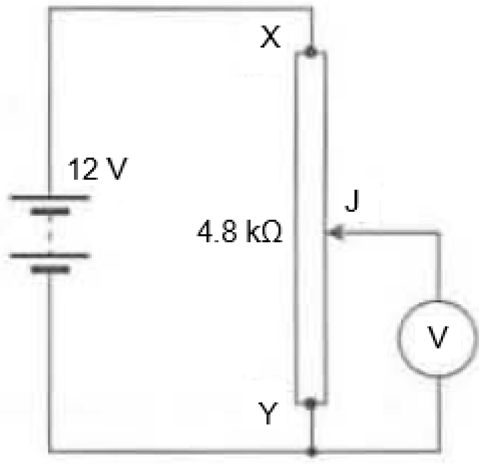


Fig. 5.1

(a) **(i)** State the reading on the voltmeter V when the student places jockey J at the mid-point between X and Y.

reading = **6 V – B1** [1]

(ii) Explain your answer in **(a)(i)**.

When J is at mid-point, resistance of XJ s equal to resistance of JY. **B1**

By potential divider principle (/ showing formula or calculations), e.m.f. (or p.d.) of 12 V is split equally between XJ & JY. **B1**

[2]

(b) The voltmeter is now replaced by an electric bell that switches on when the potential difference across it is at least 10 V.

State where the student should position jockey J on XY.

J should be placed on XY such that the ratio JY:XY is 10:12 (or 5:6). **B1**

[1]

(c) Plan

The student claims that the voltmeter reading V is directly proportional to the thickness of the resistance wire XY.

Plan an experiment to determine if this claim is true.

In your plan, you should:

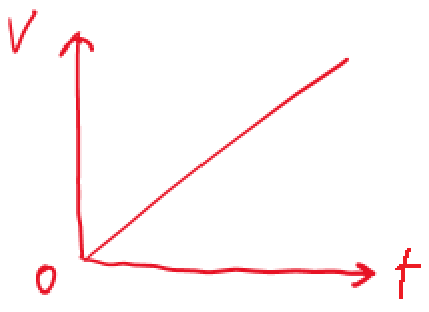
- state the quantities you will keep constant
- describe how you will perform the experiment
- sketch the graph that the student should obtain if the suggested relationship is correct.

- **Quantities to keep constant:** **B1**
  - **Length of XY**
  - **Resistivity of XY**
  - **E.m.f. of the cells**

  (any 2)
  (Note: "Temperature of surrounding air" doesn't change much)

- **Describe how to perform the experiment:**
  1. **Use at least 5 different thicknesses, *t*, of resistance wires XY.** **B2**
  2. **Position jockey J at the mid-point of XY (or any fixed point along the length of XY).** **B1**
  3. **Obtain one reading of *V* by turning off the switch, allowing circuit to return to its original temperature and turning on the switch.**
  4. **Find the average reading for potential difference.**

- **Sketch of the graph that the student should obtain:** **B1**



[4]