EUNOIA JUNIOR COLLEGE
JC2 PRELIMINARY EXAMINATION 2021
General Certificate of Education Advanced Level
Higher 1

CANDIDATE NAME	

CIVICS GROUP	2	0	-			REGISTRATION NUMBER		

PHYSICS 8867/02

Paper 2 Structured Questions

15 September 2021

2 hours

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

For Examiner's Use	
Section A	
1	9
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6	12
7	10
Section B	
8 | 9	20
S.F.	
C.F.	
Total	80

Write your name, civics group and registration number on all the work you hand in.

Data

speed of light in free space,	c	$= 3.00 \times 10^{8}$ m s^{-1}
elementary charge,	e	$= 1.60 \times 10^{-19}$ C
unified atomic mass constant,	u	$= 1.66 \times 10^{-27}$ kg
rest mass of electron,	m_e	$= 9.11 \times 10^{-31}$ kg
rest mass of proton,	m_p	$= 1.67 \times 10^{-27}$ kg
the Avogadro constant,	N_A	$= 6.02 \times 10^{23}$ mol^{-1}
gravitational constant,	G	$= 6.67 \times 10^{-11}$ N m^{2} kg^{-2}
acceleration of free fall,	g	$= 9.81$ m s^{-2}

Formulae

uniformly accelerated motion,	s	$= ut + \frac{1}{2}at^2$
	v^2	$= u^2 + 2as$
resistors in series,	R	$= R_1 + R_2 + \ldots$
resistors in parallel,	$1/R$	$= 1/R_1 + 1/R_2 + \ldots$

Fig. 1.1

The accepted value for g is 9.81 m s^{-2}.

Use Fig. 1.1 to answer the following questions. You should make calculations with clear working in support of your answer.

State and explain which group of results has

(i) larger *systematic* errors,

……..

……..

………[2]

(ii) larger *random* errors.

……..

……..

………[2]

2 (a) State Newton's second law of motion.

………..

………..

……………………………………………………………..………………………………………[2]

(b) A soccer ball of mass 0.20 kg is kicked from point A of a sloping ground as shown in Fig. 2.1.

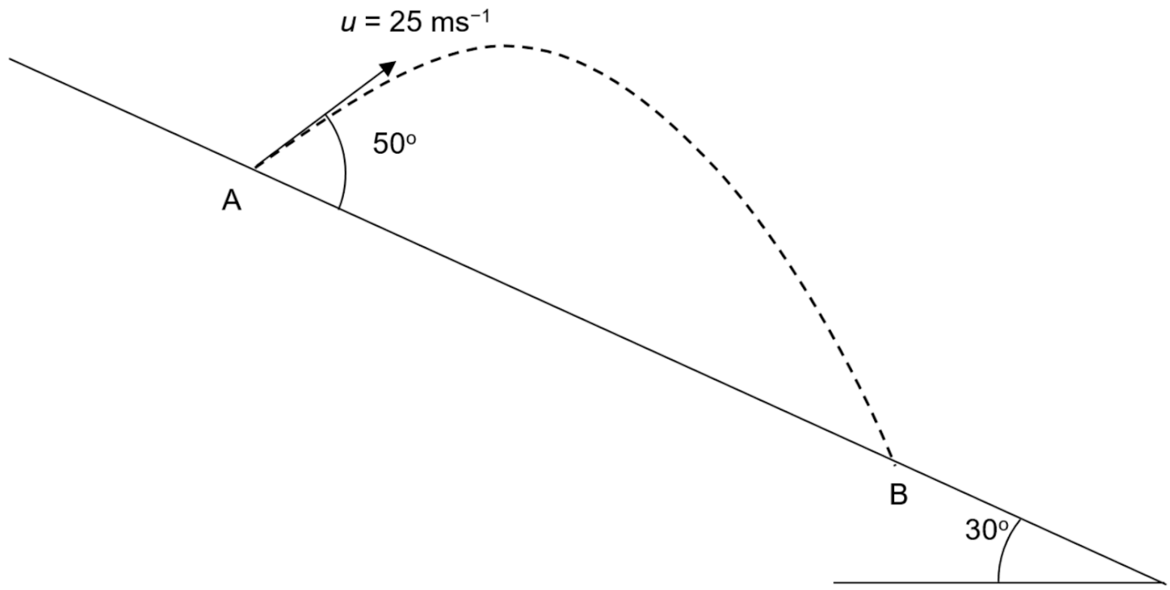


Fig. 2.1

(i) Calculate the time of travel between A and B.

time = …………………. s [3]

3 Fig 3.1 shows a man pushing a wheelbarrow with a total weight of 100 N. At the instant shown, the wheelbarrow is stationary. The dimensions of the wheelbarrow, the contact force *R* exerted by the ground on the wheelbarrow, and the combined weight *W* of the wheelbarrow and the load it carries are shown in Fig. 3.2. The force *H* exerted by the person on the wheelbarrow is not given in the diagram.

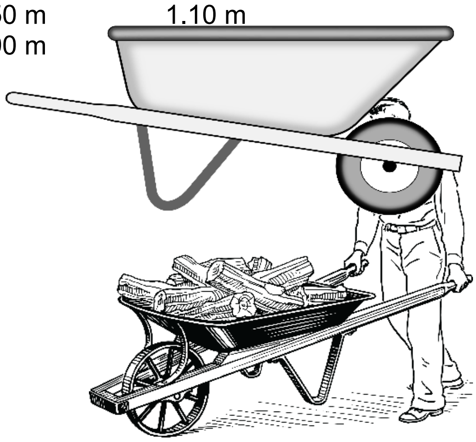


Fig. 3.1 **Fig. 3.2**

(a) Given that the force *R* exerted by the ground on the wheelbarrow acts 73° above the horizontal, determine the magnitude of *R*.

R = ………………………………….. N [2]

(b) Hence, determine the magnitude and direction of *H.*

frictional force =..N [2]

(ii) Calculate the kinetic energy of the object at the lowest point on the track.

kinetic energy =..J [2]

[Total: 7]

5 (a) A light helical spring is suspended vertically from a fixed point, as shown in Fig. 5.1.

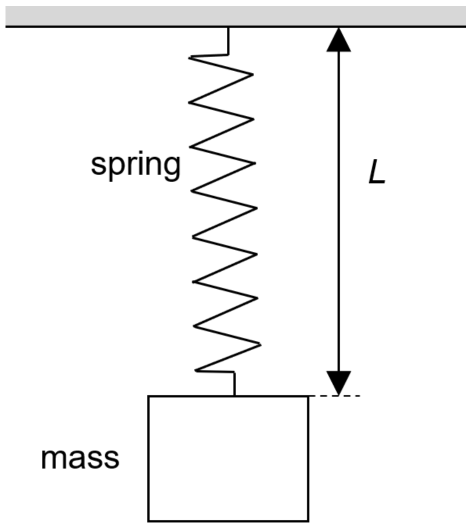


Fig. 5.1

Different masses are suspended from the spring. The weight W of the mass and the length L of the spring are recorded. The variation with weight W of the length L is shown in Fig. 5.2.

(i) Determine the total length of the spring.

length = ……………. cm [1]

(ii) For the increase in extension of 0.80 cm, determine the magnitude of the change in

1. the gravitational potential energy of the mass,

change in gravitational potential energy = ………………..…. J [1]

2. The elastic potential energy of the spring.

change in the elastic potential energy = ………………..… J [2]

(iii) Use your answer in **(ii)** to calculate the work done to cause the additional extension of 0.80 cm.

work done = …………….. J [1]

[Total: 8]

6 Fig. 6.1 shows the current-voltage (I-V) characteristics of two resistors R and X.

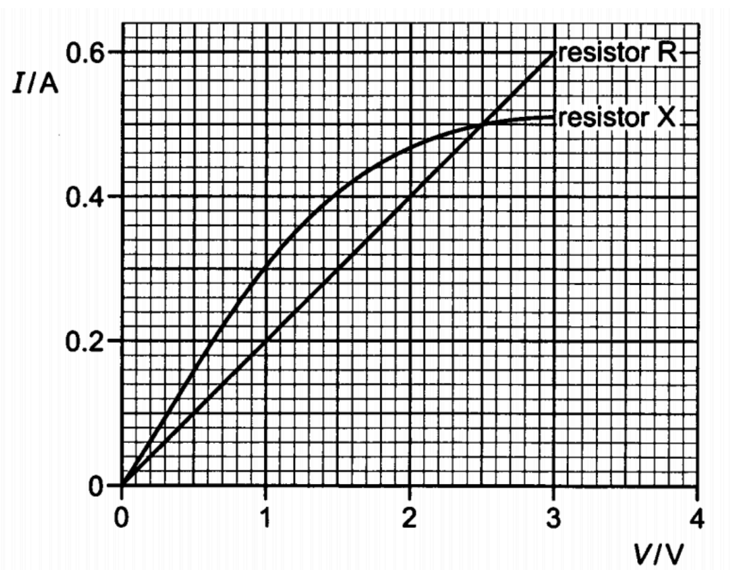


Fig. 6.1

resistance of X = ……………………. Ω

resistance of R = ……………………..Ω [2]

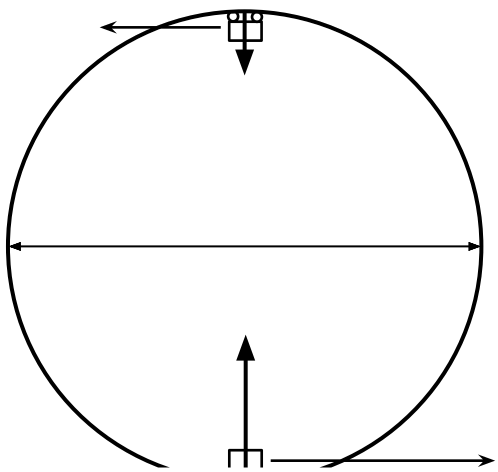
(d) Sketch the resistance-temperature characteristics of a thermistor in the space provided below.

[2]

[Total: 12]

7 A roller coaster carriage of mass m enters a circular loop-the-loop at point A with speed v_A, reaches the top of the loop at B with speed v_B and exits the loop with the same speed v_A as shown in Fig. 7.1.

The radius of the loop is R. The magnitudes of the normal contact forces acting on the carriage at A and B are N_A and N_B respectively.



A
v_A
θ
N_A
N
R
v

Fig. 7.2

(i) In order for the carriage to just reach the top of the loop (θ = 180°), the g-force at A (θ = 0°) would have to be 6.0, as shown in Fig. 7.3. The contact force at the top of the loop is then zero, and the rider would feel 'weightless'.

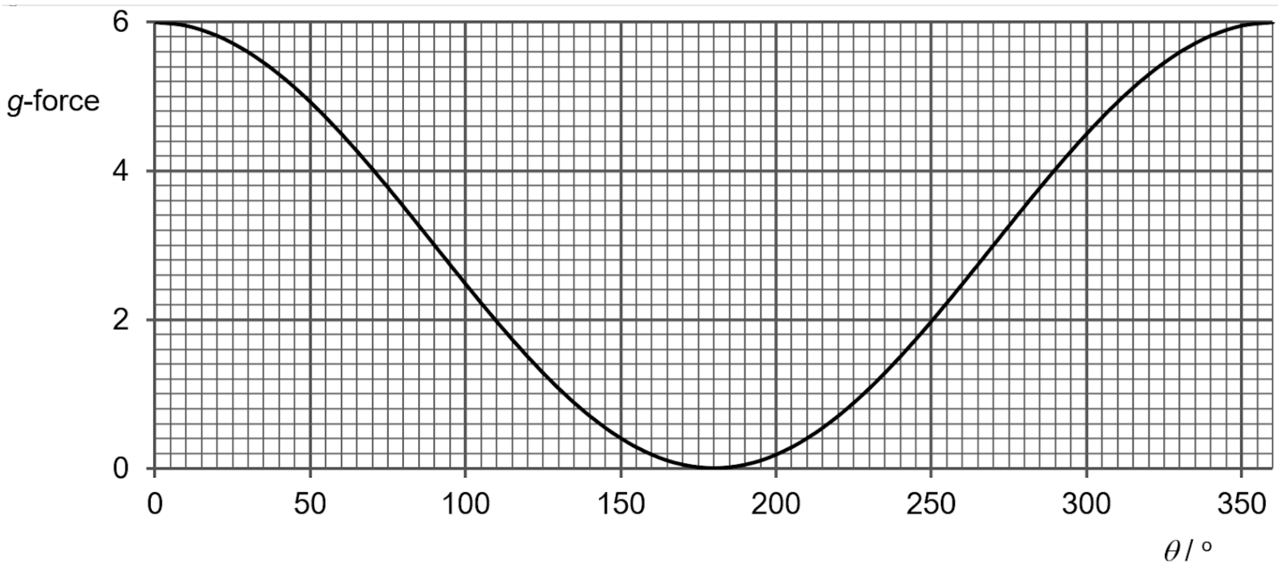


Fig. 7.3

1. Use information from Fig. 7.3 or otherwise to complete Fig. 7.4.
a_c refers to the centripetal acceleration.

[2]

θ / °	$\dfrac{a_c}{g}$
0	…………………………
90	…………………………
180	1.0

Fig. 7.4

2. Show that the speed of the carriage at A is equal to $\sqrt{5gR}$.

(i) Fig. 7.5 shows two identical loop-the-loops one after another at the Carolina Cyclone roller coaster located at Carowinds in North Carolina.

State and explain one advantage of the non-circular loop in Fig. 7.5 over the circular loop in **(a)** and **(b)**.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

……………………………………………………………………………………………[1]

(ii) Explain why the second loop in Fig. 7.5 is lower in height than the first loop.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

……………………………………………………………………………………………[1]

[Total: 10]

Section B

Answer **one** question from this section.

8 **(a)** Fig. 8.1 shows a mass initially travelling at right angles to the Earth's uniform gravitational field.

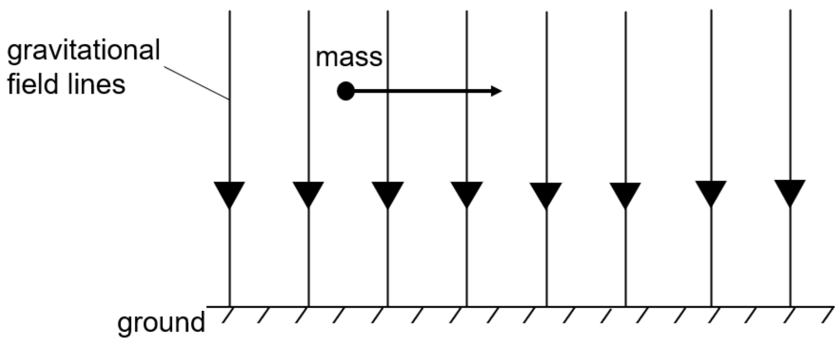


Fig. 8.1

(i) State the direction of the gravitational force experienced by the mass.

……

……

……

……[2]

(d) **(i)** Define magnetic flux density.

……………………………………………………………………………………………

……………………………………………………………………………………………[2]

(ii) Sketch on Fig. 8.4 the magnetic flux pattern around a long straight wire carrying a current upwards towards the paper.

[2]

(iii) Use your diagram from Fig. 8.4 to deduce and sketch, on Fig. 8.5, the magnetic flux pattern around two long straight wires carrying equal currents upwards through the paper.

[2]

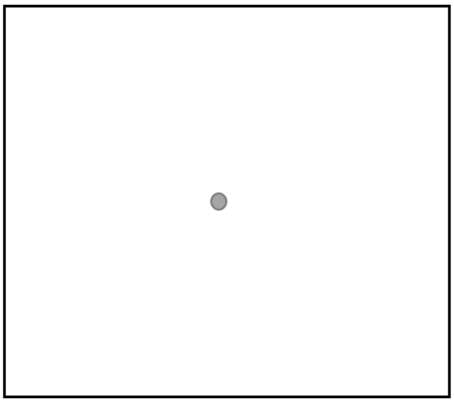


Fig. 8.4

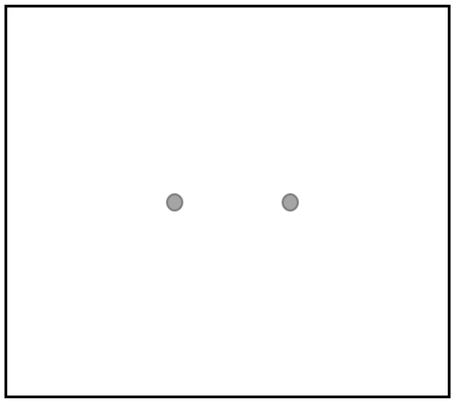


Fig. 8.5

(e) A large horseshoe magnet produces a uniform magnetic field of flux density B between its poles. Outside the region of the poles, the flux density is zero. The magnet is placed on a top-pan balance and the wire XY is situated between its poles, as shown in Fig. 8.6.

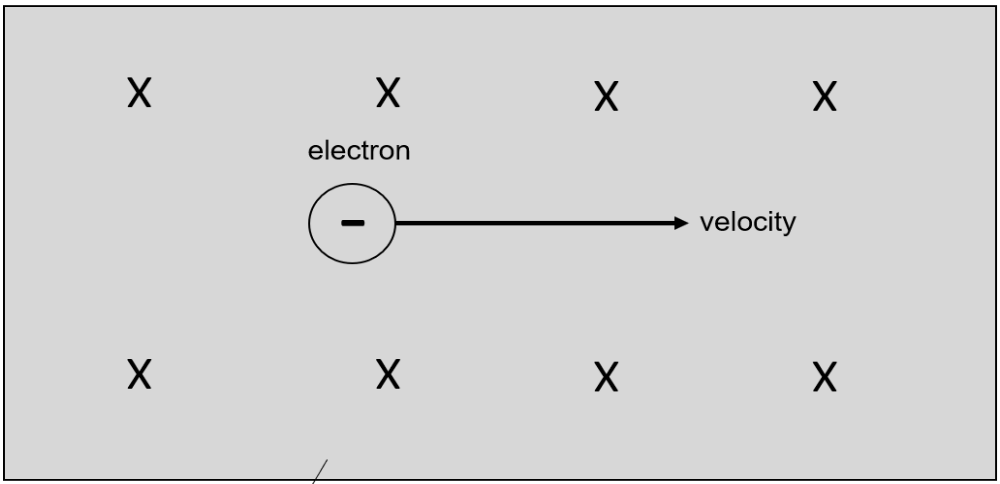


Fig. 8.7

The magnetic field is into the plane of the paper.

(i) On Fig. 8.7, indicate with an arrow the direction of the force experienced by the electron. [1]

(ii) Explain why the force experienced by the electron due to the magnetic field does not change the speed of the electron.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………….[2]

[Total: 20]

9 **(a)** A coil of 1500 turns of insulated wire is tightly wound on a non-magnetic tube to make a solenoid of mean radius 22 mm, as shown in Fig. 9.1. The wire itself has radius 0.86 mm and is made of a

(c) The magnetic flux density in the solenoid is measured using a current balance. The current balance is a U-shaped piece of stiff wire ABCDEF pivoted at BE, as shown in Fig. 9.2.

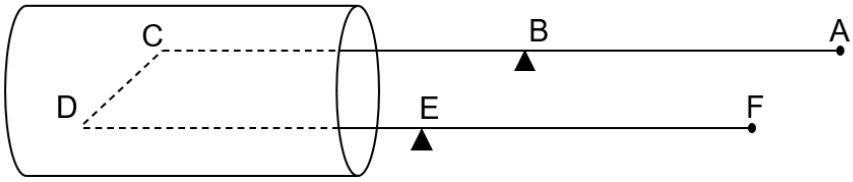


Fig. 9.2

When in used, there is a turning force on the stiff wire caused by a current in CD.

(i) Explain why the current in CD causes a turning effect.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………[3]

(ii) Explain why currents in CB and DE do not contribute to the turning force.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………[1]

(iii) CD has length 25 mm, CB and DE each have length 106 mm.