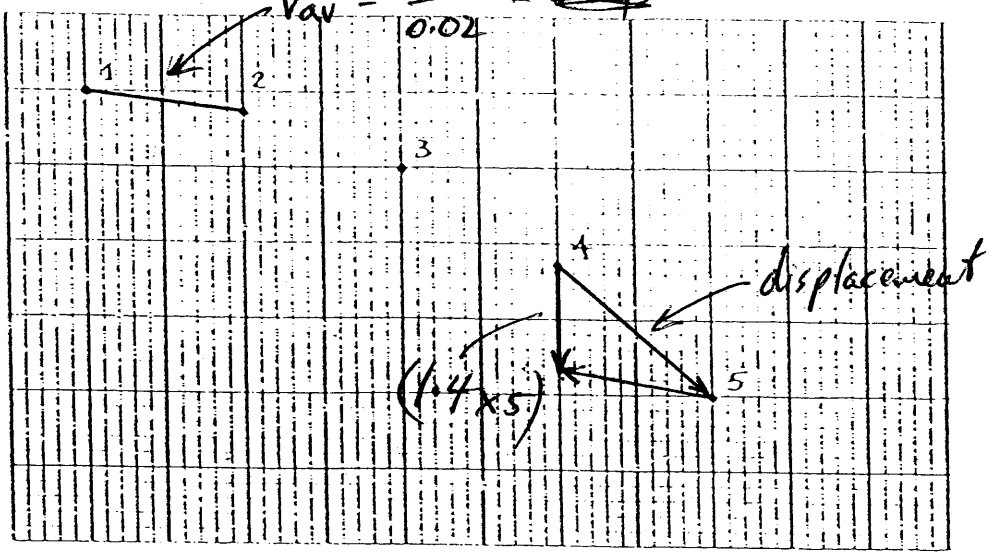
ONE MORE TIME, WITH FEELING!

Station 1

(10 marks)

The graph shows a multiflash picture of a projectile taken on Planet X. It is 1/5th (one-fifth) size and the time between photographs is 0.02 seconds. The following questions deal with true values, not scaled down values.



6.75 m/s

5.25 m/s

(a) **Determine how far the projectile moves in a horizontal direction in 0.02 seconds? (1 mark)**

10 cm or 0.1 m (i.e. 2 cm x 5)

(b) **Determine the horizontal velocity of the projectile. (1 mark)**

$V_h = \frac{0.1\,m}{0.02\,s} = 5\,ms^{-1}$

(c) **Indicate on the graph the displacement between the 4th and 5th photograph and determine its magnitude. (1 mark)**

2.7 x 5 = 13.5 cm or 0.135 m

Or 2.75 x 5 = 13.75 cm or 0.1375 m

(d) **Determine the magnitude of the average velocity between the 4th and 5th photograph. (2 marks)**

$\frac{13.75}{.02} = 6.875\ ms^{-1}$

using $13.5 \rightarrow 6.75\ ms^{-1}$ $\quad 14\ cm \rightarrow 7\ ms^{-1}$

(e) **Determine the magnitude of the change in average velocity between section (1-2) and section (4-5). Indicate clearly on the graph how you did this and calculate the value of the change in average velocity over this time period. (3 marks)**

$\Delta v = v - u$

$= 1.4 \times 5 = \frac{7}{.02}$

$= 3.5\ ms^{-1}$ vertically

(f) **Hence determine the acceleration due to gravity on Planet X. (2 marks)**

$a = \frac{\Delta v}{\Delta t}$

$= \frac{3.5}{3 \times .02}$

$= 58.3\ ms^{-2}$ down.

STATION 2
(10 MARKS)

MY COMPUTER
Data on Hmltn-adm [I:]
Physics Prac Test
P11e0105 file
Open the applet called "phe" file.

Open the applet lorentzforce. Read the information.

Click on maximise (next to X in the top right hand corner).

1. **In the diagram the colour for the North pole is**.....Orange/Red/Brown..... **(1)**

2. **With the current into the page and magnetic field lines down the page, the direction of the Lorentz force is** ..to left..... towards magnet, Inwards, In ..... **(1)**

Use the back arrow to return to "phe".

Open the applet electricmotor and read the information.

N.B. orthogonal = at right angles to

3. **Organise the apparatus so that if the current in the circuit to the brushes is clockwise and the direction of the magnetic field is down the page.**

   Then when the coil is horizontal the Lorentz force is.....Zero..... **(1)**

4. **What is the direction of rotation in the situation described in question 3?**

.....anticlockwise viewed from brushes.....**(1)**
clockwise looking towards brushes

5. **Using the right hand rule described in the applet. Explain why the coil rotates in the direction described in Question 3. (2 marks)**

Conventional Current I into page
Forefinger B down the page
Middle finger F onto the left on the upper part of coil
" " " right " " lower part of coil

File then Close

Continued over page

Station 2 continued

Use the back arrow to return to "phe".

Open the applet "generator-e" and read information.

Click on maximise (next to X in top right hand corner).

Organise your apparatus with a commutator and the magnetic field down the page.

So when the handle is rotated anti-clockwise.

6. What is the nature of the voltage produced. (1 mark)

varying higher DC voltage ..... Varying +ve DC Voltage.

7. Describe the nature of the induced current produced. (1 mark)

varying +ve Direct Current

8. Describe the effects of increasing the speed of rotation if there is no commutator in the apparatus.(2marks)

Increase the voltage

Voltage changes faster (higher frequency)

Voltage is AC

File then Close

Optional question

Explain what the conditions which induce the maximum voltage available.

i) When the coil is vertical

ii) Maximum rotational velocity

STATION 3
(5 MARKS)

Use the back arrow twice to return to display with applet "Photo effect".

Click on maximise next to X in top right hand corner.

Set the voltage at 0.0V. (*caution* make sure you use 0.0v and NOT –0.0V)

(a) Select Sodium and then vary the light wavelength until the photo-current occurs. ie. the longest wavelength to cause the emission of photoelectrons. Repeat this process for Silver. Place results in the table provided. (2 x 1/2 mark each)

Materials	Wavelength (nm)	
SODIUM	450	451
SILVER	292	291

(b) Describe the effect of increasing the light intensity when the wavelength is 20nm greater than the onset value. (1 mark)

No effect

.....

(c) Describe the effect of increasing the voltage when the wavelength is 20 nm less than the onset value. (1 mark)

Increases the photo current

.....

(c) **Using ONE of your results from the table above show how you can use that value to determine the work function (ie. The energy needed to cause the emission of photoelectrons which is the energy of the incident light) for that material. Indicate which material that you are using. (2 marks)** **Material**.....

Na = 2.75eV
Ag = 4.26eV

Sodium	Silver	
E = hf	E = hf	
$= \frac{6.626\times10^{-34} \times 3\times10^{8}}{450\times10^{-9}}$	$= \frac{6.626\times10^{-3} \times 3\times10^{8}}{291\times10^{-9}}$	292nm
$= 4.4173\times10^{-19}$ J	$= 6.83\times10^{-19}$ J	6.8075×10^{-19} J
$= 4.76$ eV	$= 4.269$ eV	4.25eV

Using 451nm ↓ 4.4075 ↓ 2.75eV

File then Close ,
then Back arrow twice
and Then Close in top right hand corner.

$f = \frac{3\times10^{8}}{450\times10^{-9}} = 6.67\times10^{14}$

$= 6.65\times10^{14}$

451

$\frac{3\times10^{8}}{291\times10^{-9}}$ $f = 1.03\times10^{15}$ 1/2

$\frac{3\times10^{8}}{292\times10^{-9}} = 1.028\times10^{15}$ Hz

(Define onset value better)

STATION 4
(5 MARKS)

Refer to data sheet and equation sheets where necessary.

(a) State the value for n_f in the Balmer's Series so that Rydberg's equation will produce values consistent with laboratory values using hydrogen gas?

$n_f =$ 2 **(1 mark)**

(b) Rydberg's equation is a mathematical equation, which fitted the known values for the wavelengths of light emitted by hydrogen gas.

The wavelengths of Hydrogen shown in the Table below were obtained by a student using a spectrometer. Show that these values agree with the predictions of the Rydberg equation.

Indicate the transition responsible for H_γ in the table. (1 mark)

Line	Colour	Wavelength (nm)	Transition n_i to n_f
H_α	RED	656	[redacted]
H_β	BLUE/GREEN	486	[redacted]
H_γ	BLUE/PURPLE	434	5 to 2
H_δ	VIOLET	410	[redacted]

Space for calculation to justify the answer for the H_γ ie λ=434nm (2 marks)

$n_i =$ 5 and $n_f =$ 2

$H_\gamma = \frac{1}{\lambda} = 1.097 \times 10^7 \left(\frac{1}{4} - \frac{1}{25}\right)$

$= 434.0842992 \times 10^{-9}$

$= 434 \text{ nm}$

$\frac{1}{\lambda} = 2303700$

$\therefore \lambda = 4.34 \times 10^{-7}$

(c) Given that the ionisation energy of Hydrogen (E_1) is – 13.6 eV.

Show that it is the product of R_H, h and c. (1 mark)

NB 1eV =1.6 x 10^{-19} J

$E_1 = 1.097 \times 10^{7} \times 3 \times 10^{8} \times 6.626 \times 10^{-34}$

$= 2.1806166 \times 10^{-18}$ J $\div 1.6 \times 10^{-19}$

$= 13.611838956$ eV ✓

END OF PRACTICAL ASSESSMENT