PRE-LEAVING CERTIFICATE EXAMINATION, 2006

MARKING SCHEME

PHYSICS

HIGHER AND ORDINARY LEVEL

Table of Contents

HIGHER LEVEL

QUESTION 1

u	v	1/u	1/v	1/u + 1/v	f
74.3	37.6	0.01346	0.02660	0.04006	24.96
58.3	43.8	0.01715	0.02283	0.03998	25.01
36.1	81.3	0.02770	0.01230	0.04	25.00

Average value of f = 25 cm **(15)**

Diagram to show light source, object, concave mirror, screen, metre-stick **(6)**

Measure u from object to mirror
Measure v from mirror to screen **(3)**

The position of the screen to obtain clearest image is subjective / It may not be certain where the clearest image is / Different students may see clearest image in slightly different positions / There may be up to 1 cm uncertainty in position of clearest image **(6)**

So it is not useful to measure correct to 1 place of decimals **(3)**

With u over 2 m,
Little variation in values for v **(4)**

With u less than 20 cm
Image cannot be formed on screen / Image is not real **(3)**

QUESTION 2

4.7 + X = 2.4 + 1.5 + 2.1 + 2.3
X = 8.3 – 4.7
X = 3.6 N **(3)**

The vector sum of the forces in any direction is zero **(6)**

Clockwise moments:
2.4 × 10 + 1.5 × 25 + 2.1 × 50 + 2.3 × 95
= 24 + 37.5 + 105 + 218.5
= 385 M cm **(6)**

Anticlockwise moments:
4.7 × 20 + 3.6 × 80
= 94 + 288
= 382 N cm **(6)**

Sum of clockwise moments equal sum of anticlockwise moments
(within bounds of experimental error) **(6)**

Diagram to show metre stick, some downward weights, upward Newton balances **(6)**
(Not necessarily the weights and positions given in the question)

Metre stick not horizontal
The error is uniform on all distances, so cancels / Multiply all distances by cosθ, but this factor cancels out

or

Upward forces not vertical
There must be a <u>horizontal</u> component, so the sum of forces (as measured) will not equal the sum of the downward forces **(7)**

QUESTION 3

mL + mcΔθ (melted ice)
= mcΔθ (water) + mcΔθ (calorimeter)

0.0182L + 0.0182 × 4180 ×13.8
= 0.0884 × 4180 × 17.7 + 0.0752 × 390 × 17.6

0.0182L + 1049.8
= 6503.4 + 516.2

0.0182L = 5969.7

L = 328007

L = 3.3×10^5 J kg^{-1} **(15)**

Find mass of water plus calorimeter before ice is added and again after ice is added, then subtract. **(6)**

(i) Ice is a poor conductor of heat **(3)**

Inside may be at a lower temperature **(3)**

(ii) Ice melts at 0 °C **(6)**

(i) Greater temperature change, lower percentage error **(4)**

(ii) Greater heat loss to the surroundings **(3)**

QUESTION 4

Diagram to show:
Bunsen and water bath
Test tube with glycerol
Thermistor with leads to ohmmeter
Thermometer **(9)**

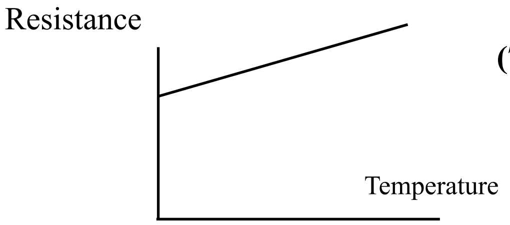
To ensure temperature reading on thermometer is same as temperature of thermistor /
To ensure thermal equilibrium. **(6)**

The following results were obtained.

Temperature / °C	15	30	45	60	75	90
Resistance / Ohms	500	350	245	170	120	85

Axes properly labelled **(3)**
Points plotted **(6)**
Smooth curve through the points **(3)**

Increasing temperature:
more free electrons
Greater conductivity
Lower resistance **(6)**



(7)

QUESTION 5

(Answer *eight* of the following)

(a) Force to give mass of 1 kg an acceleration of 1 m s^{-2} **(7)**

(b) Any one of: swing / simple pendulum / vibrating string / Bouncing ball, etc **(7)**

(c) Optic fibres / binoculars / etc **(7)**

(d) W m^{-2} **(7)**

(e) $\frac{\text{Velocity in air/vacuum}}{\text{Velocity in medium}}$ **(7)**

(f) Force decreases in proportion to the square of the distance **(7)**

(g) To force vapour to condense to a liquid **(7)**

(h) Doppler effect **(7)**

(i) Electrical short large current flows to earth Fuse blows **(7)**

(j) State the quark composition of a proton and of a neutron
Proton = uud Neutron = udd

or

State how a galvanometer can be converted to an ammeter **(7)**
Low resistor in parallel

QUESTION 6

Define (i) work, (ii) momentum
(See textbook)
(6)

State the principle of conservation of momentum **(6)**
(See textbook)

Momentum given to gas (opposite to direction of spacecraft) Equals increase in momentum of spacecraft, so it accelerates

or

Force applied to hot gas equal and opposite to force on spacecraft So it accelerates **(6)**

Increase in momentum of spacecraft
= mv –mu
= 450 × 1200 - 450 × 1100
= 540000 – 495000
= 45000 kg m s^{-1}

Momentum of hot gas: 2500M = 45000

M = 18 kg **(9)**

Why does an astronaut in a spacecraft feel weightless in space?
Force (weight) on astronaut equals centripetal force
(5)

W = mg = 25 × 9.8 = 245 N **(3)**

Required force = 245 sin 20°
= 245 × 0.3420
= 84 N **(9)**

Work = force × distance
= 84 × 25
= 2100 J. **(3)**

Total work = 6 × 2100 = 12600 J

Power = work / time
= 12600 / 60
= 210 W **(6)**

Power efficiency = (210 / 350) × 100
= 60 % **(3)**

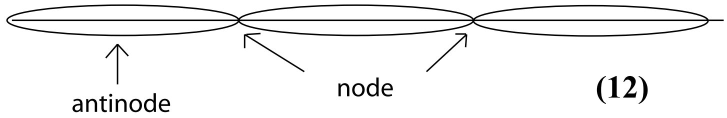
QUESTION 7

[Wave motion]
Two loudspeakers connected to signal generator. Loud and soft as you move in live parallel to speakers
⟶ Interference
Hence wave motion **(9)**

[Interference]
When waves from two sources meet a new wave is produced. The displacement produced at any point is the algebraic sum of the displacements that each wave would produce on its own.
(6)

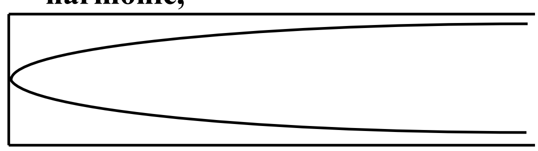
[Stationary wave]
Two periodic waves of the same frequency and amplitude moving in opposite meet, they interfere with each other and produce a stationary wave. **(6)**

Draw

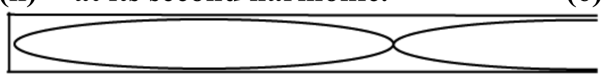


(12)

(i) **at its fundamental frequency, or first harmonic,**



(ii) **at its second harmonic.** **(6)**



$\frac{3}{4}\lambda$ = 17 cm.
λ = 22.666 cm
= 0.22666 m

vel = f λ
f = vel / λ
= 340 / 0.22666
= 1500 Hz **(12)**
Different harmonics/ overtones present
(5)

QUESTION 8

Diagram to show:
straight wire
Indication of direction of current
Plotting compasses to show magnetic field
Concentric circles, with direction arrows.
(9)

Has both strength (magnitude) and direction **(6)**

Diagram to show:
solenoid with electric cell
Lines to show direction of magnetic field
(same pattern as for bar magnet)
(9)

Diagram to show:
magnet / aluminium foil (or other)
Turn on current
Movement implies force **(6)**

Two of: motors, meters, loudspeakers **(6)**

$F = I\,l\,B = 3.5 \times 0.08 \times 1.75 = 0.49$ N **(6)**

A conductor of length 1 m carrying a current of 1 A experiences a force of 1 N when placed perpendicular to the field **(6)**

Given: $F = I\,l\,B$
Length of conductor = l
Time for charges to pass through conductor = t
Velocity of charges = l / t hence l = vt (A)
Total charge in conductor = nq
Current flowing in conductor, I = nq / t (B)
Substitute into $F = I\,l\,B$, gives
$F = (nq / t)\, vt\, B$
Hence $F = nqvB$
Or force on single charge is qvB **(8)**

QUESTION 9

Millikan **(3)**

Smallest known charge / All charges of multiples of this value **(6)**

Apart from carrying charge, state two other properties of the electron. **(6)**

(Textbook)

$eV = \frac{1}{2} mv^2$
$1.6 \times 10^{-19}\, V = \frac{1}{2} \times 9.1 \times 10^{-31} \times (4.5 \times 10^{-7})^2$
$1.6 \times 10^{-19}\, V = 92.1375 \times 10^{-17}$
V = 5760 Volts **(9)**

Force is perpendicular to velocity **(3)**

So acts as centripetal force and it moves in a circle **(3)**
$(F =)\ Bqv = mv^2/r$
$r = mv / Bq$
$= \dfrac{9.1\times10^{-31}\times4.5\times10^{7}}{2.3\times10^{-2}\times1.6\times10^{-19}}$

$= 1.113 \times 10^{-2}$ m **(6)**

High speed electrons
Hit dense metal target
Their kinetic energy is converted into X-rays /electromagnetic radiation **(9)**

Number of electrons per second = current / charge on electron
$= 3.2 \times 10^{-5} / 1.6 \times 10^{-19}$
$= 2 \times 10^{14}$ (electrons per second) **(6)**

Cathode Ray Oscilloscope
TV **(5)**

QUESTION 10

(a) Any two of: electromagnetic, strong nuclear, weak nuclear AND corresponding property **(12)**

In beta decay both energy and omentum appeared not to be conserved. The existence of the neutrino was proposed to account for missing energy and momentum. **(9)**

It interacts only very weakly with matter – has no charge **(6)**

$e^- + e^+ \rightarrow 2\,h\,f$ **(6)**

2 electrons = $2mc^2$
$= 2 \times 9.1 \times 10^{-31} \times (3 \times 10^8)^2$
$= 1.638 \times 10^{-13}$ J **(6)**

$2\,h\,f = 2 \times 6.6 \times 10^{-34}\, f$
$f = 1.24 \times 10^{20}$ Hz **(9)**

Leptons: electron, neutrino, muon (and neutrino), tau (and neutrino)

Baryons: Proton, neutron, lambda, sigma **(8)**

(b) The adding of small controlled amounts of impurities to a pure semiconductor to increase its conductivity **(6)**

(i) p-type:
Add Boron (valency = 3) to increase no. of positive holes **(6)**

(ii) n-type, semiconductor.
Add Phosphorus (valency = 5) to increase no. of free electrons **(6)**

Diagram to show:
npn transistor with labels: collector base emitter **(9)**

Base is lightly doped **(3)**

Collector and emitter are more heavily doped **(3)**

$I_e = I_c + I_b$
(Emitter current = collector current + base current) **(6)**

Diagram to show:
transistor
cell
load resistor
input and output **(12)**

Temperature controlled switch
Light controlled switch, etc. **(5)**

QUESTION 11

(a) Molecules in a gas have a range of kinetic energies (or speeds)/ Temperature depends on kinetic energy. **(7)**

(b) Its velocity increases. **(7)**

(c) It is not possible to have a lower temperature **(7)**

(d) no motion and no heat / all atomic and molecular motion stops **(7)**

(e) One of:
Resistance of a conductor changes with temperature /
Resistance of a thermistor changes with temperature /
Voltage of a thermocouple changes with temperature **(7)**

(f) Infra Red **(7)**

(g) It bends / The two metals expand at different rates **(7)**

(h) Heat is a measure of energy. Temperature is a measure of how hot **(7)**

QUESTION 12

(a) **State Boyle's law** **(6)**
Textbook

Diagram to show:
method of changing volume or pressure
Method for measuring volume
Method for measuring pressure **(6)**

Volume of gas container has uniform cross-section, so length is proportional to volume **(6)**

As volume is decreasing, Temperatures of gas rises, Greater value for pressure (than at constant temperature), Greater value for pV
(And/or vice versa) **(10)**

(b) The decay of nuclei of certain atoms with the emission of one or more types of radiation. **(6)**

Two of:
Range in air
Ionising ability
Penetrating power
Deflection in electric or magnetic fields
Note: *with comparisons for each type: alpha, beta and gamma* **(9)**

Geiger counter
Solid state detector + discription **(9)**

$${}^{234}_{91}Pa \rightarrow {}^{234}_{92}U + {}^{0}_{-1}e$$ **(4)**

Beta particle emitted.

(c) Graph to show sine curve – alternately positive and negative **(6)**

$V_{peak} = \sqrt{2} \times 220 = 311$ Volts **(6)**

P = VI
I = P/V = 2500 / 220 = 11.36 A
V = IR
R = V/I = 220 / 11.36 = 19.36 Ohms **(6)**

Heat = $mc\Delta\theta$
= 1.4 × 4180 × 82 = 479864 J
Time = energy / power
= 479864 / 2500 = 192 seconds **(10)**

(d) Rate of change of angle with respect to time **(6)**

Derive the formula $v = \omega r$

Diagram to show:
arc and radius of circle
In small time, t:
Arc length = vt
Angle = ωt

Radian measure = arc length / radius =

So $\omega t = vt / r$

Hence $v = \omega r$ **(9)**
(Or other suitable notation)

Kinetic energy (at B) = potential energy (at A)

$\frac{1}{2} mv^2 = mgh$ **(3)**

$v^2 = 2gh = 2 \times 2 \times 9.8 = 39.2$

$v = 6.26$ m s^{-1} **(6)**

$v = \omega r$
so $\omega = v / r$
= 6.26 / 2
= 3.13 rad s^{-1} **(4)**

ORDINARY LEVEL
SECTION A
QUESTION 1

In an experiment to verify the principle of conservation of momentum:
Find the momentum of the first trolley before the collision

Momentum = mv = 0.4 × 2.4
= 0.96 kg m s^{-1}

(9)

Find
(i) the total mass of the two trolleys
0.4 + 0.8 = 1.2 kg

(3)

(ii) the momentum of the two trolleys after the collision.
1.2 × 0.8 = 0.96 kg m s^{-1}

(6)

State how these results verify the principle of conservation of momentum
Momentum before equals momentum after

(6)

Explain how the velocity of the first trolley could heave been measured.
Ticker timer tape, 50 dots per second

(6)

Measure distance between a number of dots **(3)**

Velocity = distance / time

(3)

How can you ensure the trolleys move at the same velocity after the collision
Velcro/magnets/cork and pin, etc

(4)

QUESTION 2

Draw a labelled diagram of the experiment

Diagram to show: calorimeter plus water, thermometer, blotting paper, scales

(12)

Why was the water warmed?

One of:
To insure the ice melts quickly /
Allows more ice to be added /
Allows greater temperature change

(6)

What should be the temperature of the ice when it is added to the water?
0^oC **(6)**

Why it was necessary to measure the mass three times?
Mass of calorimeter
Mass of calorimeter + water
Mass of calorimeter + water + melted ice

(9)

Explain why there would be inaccuracies if hot water were used instead of warm water.
Greater heat loss to the surroundings

(7)

QUESTION 3

Copy this table and fill in the last row by calculating 1 / length for each measurement

Frequency / Hz	200	280	360	420	480
Length / m	0.8	0.57	0.44	0.38	0.33
$\frac{1}{\text{Length}}$ / m^{-1}	1.25	1.75	2.27	2.63	3.03

(7)

Plot a graph on graph paper of 1 / length against f
Labelled axes **(3)**
Points plotted **(6)**
Straight line (ruled) **(3)**

What does the graph tell you about the relationship between frequency and length
Frequency in proportional to 1 / length
/ Frequency in inversely proportional to length

(6)

Draw a labelled diagram of the apparatus used in the experiment.
Diagram to include:
Sonometer and metre stick **(3)**
Tuning fork **(3)**
Means of adjusting length **(3)**

State how the frequency was measured.

Frequency is stamped on tuning fork /
Read from digital frequency meter
(6)

QUESTION 4

In an experiment to investigate how the resistance of a metallic conductor varies with temperature:
Draw a graph of resistance against temperature
Labelled axes **(3)**
Points plotted **(6)**
Straight line **(3)**

Draw a diagram of the apparatus used to carry out the experiment.
Water bath and Bunsen burner **(3)**
Resistance coil in oil **(3)**
Ohmmeter **(3)**
Thermometer **(3)**

State how
(i) the temperature is changed
Heat the water **(3)**
(ii) the temperature is measured
read the thermometer **(3)**
(iii) the resistance is measured
ohmmeter **(6)**

The graph shows us that the resistance of the metallic conductor increases with temperature.
Name a device, or material, whose resistance decreases with temperature.
Semiconductor / thermistor (4)

SECTION B (280 marks)

Answer five questions from this section.
Each question carries 56 marks.

QUESTION 5

(a) Convert a speed of 120 km h^{-1} to m s^{-1}

120 km / h = 120 000 m / 3600 sec
= 33.33 m s^{-1}
(7)

(b) Newton's third law of motion is sometimes summarised as:
"to every action there is an equal and opposite reaction"
Give an everyday example of this law.

Recoil of gun
Acceleration of spacecraft
Jump off a boat, etc **(7)**

(c) State how light travels along optic fibres
Total internal reflection
(7)

(d) Give two renewable forms of energy.

Two of: wind / solar / wave / tidal / biomass, etc
(7)

(e) State Archimedes' principle.

When a body is partially or completely immersed in a fluid it experiences an upthrust equal in magnitude to the weight of the fluid displaced.
(7)

(f) What is meant by a monochromatic light source?
contains only one frequency /wavelength
(7)

(g) Give an example of a thermometric property.
length of mercury column / electrical resistance / colour /

Volume of gas at constant pressure / pressure of gas at constant volume

(7)

(h) Name the device that can change the voltage of an alternating current.

Transformer **(7)**

(i) State two properties of the electron.

Two of: has mass, negatively charged, orbits the nucleus

(7)

(j) What is meant by ‘background radiation’?

Nuclear radiation always present (from: outer space, rocks, etc) **(7)**

QUESTION 6

Define
(i) velocity Rate of change of displacement / speed in a given direction **(6)**
(ii) acceleration
Rate of change in velocity /
Change in velocity/time taken

(6)

State what is meant by
(i) force Force causes acceleration / force causes change in velocity **(6)**
(ii) kinetic energy
energy a body has due to its motion

(6)

The car can accelerate from stationary to a velocity of 80 m s-1 in 5 seconds.
Find its acceleration and the distance it travels while it is accelerating.

Acceleration = $\frac{(80-0)}{5}$ = 16 m s^{-2}

(6)

Distance = $\frac{u+v}{2}$ t = $\frac{80}{2}$ × 5 = 200 m

(6)

Given that the mass of the car is 940 kg, find the force needed to cause this acceleration.
F = ma = 940 × 16 = 15040 N

(6)

Find its kinetic energy when it is travelling at 80 m s^{-1}

E = $\frac{1}{2}$ mv^2 = $\frac{1}{2}$ × 940 × 80^2
= 3008000 J

(6)

The drag car uses a parachute to help slow down.
How does the parachute help the car to slow down?
Increased air resistance

(4)

The driver wears a seat belt.
Explain how they help the driver when the car is slowing down
Applies force opposing motion of driver

(4)

QUESTION 7

Copy the diagram and show the path of the rays after they pass through the lens

Diagram to show rays passing through lens and meeting

(9)

Name the point where the rays meet, and state the type of lens.
Focus / focal point **(6)**
Converging / convex **(6)**

Using a lens similar to the one shown, it is found that when an object is placed 20 cm from the lens an image is formed 60 cm from the lens.
Find
(i) the focal length of the lens,

$$\frac{1}{20}+\frac{1}{60}=\frac{3}{60}+\frac{1}{60}$$

$$=\frac{4}{60}=\frac{1}{15} \qquad f=15\ cm$$

(12)

(ii) the magnification.

magnification = v/u = 60/20 = 3

(6)

The human eye contains a lens similar to the one shown.
Name the part of the eye when the image is formed
Retina

(6)

State what is meant by 'short sight' and state the type of lens used to correct short sight.
Image if formed in front of retina /
Can only see objects close to the eyes

(6)

Corrected by: concave lens

(5)

QUESTION 8

What is meant by an electric current?

Flow of electric charge **(6)**

Name two sources of e.m.f.
Two of : simple cell / generator / alternator / thermocouple

(6)

Give a formula linking I_1 I_2 I_3, I_4 and I_5

$I_1 + I_2 = I_3 + I_4 + I_5$

(6)

Draw two circuit diagrams to show the resistors connected
(i) in series
(ii) in parallel
standard configuration for each

(6 + 6)

Calculate the effective resistance in each case, and find the current flowing in the series circuit.
(i) series:
60+120 = 180 Ohms

(3)

(ii) parallel $\frac{1}{R}=\frac{1}{60}+\frac{1}{120}$

$$=\frac{2}{120}+\frac{1}{120}$$

$$=\frac{3}{120}$$

$$=\frac{1}{40}$$

R = 40 Ohms **(6)**

Current in series:

$(I=\frac{V}{R})$ $I=\frac{12}{180}$ = 0.067 Amps

(3)

What is meant by a 'semiconductor'?
Substance whose resistance is between that of a good conductor and a good insulator

(6)

Name a semiconductor whose resistance reduces when light is shone on it, and give a use for this device.

LDR **(4)**

Use: Any light controlled switch, etc

(4)

QUESTION 9

A polythene rod may be charged by rubbing it with a woollen cloth.
Explain in terms of electrons how the polythene becomes negative and the wool becomes positive.

Polythene gains electrons
Wool loses electrons

(6)

Describe how you would show that
(i) like charges repel,
(ii) unlike charges attract.

Experiment to show: rod suspended, free to rotate **(3)**
Second rod held **(3)**
State: like charges move away **(3)**
Unlike charges move towards each other **(3)**

Give
(i) an everyday example of static charges,
Clothes of different synthetic materials /
Dust on TV screen **(4)**

(ii) a danger of static charges

Explosions in flour mills
Refuelling aircraft
Lightning **(4)**

Explain how you could charge sphere B by induction.

Bring A close to B **(3)**
Earth opposite side of B **(3)**
Remove earth from B **(3)**
Separate spheres / charge remains on B **(3)**

Copy sphere A and draw the electric field (lines of electric force) due to the positive charge.

Diagram to show radial lines starting at sphere and arrows pointing away **(12)**

If a negative charge were brought near to this positive sphere it would experience a force.
In which direction would the force on the negative charge be?
Towards the positive sphere **(6)**

QUESTION 10

What is meant by radioactivity?
Decay / disintegration of nucleus (with the) **(3)**
emission of one or more types of radiation **(3)**

Name the three types of radioactive particles.
Alpha, beta, gamma **(9)**

(i) which one is unaffected by electric fields, gamma **(3)**
(ii) which one has the shortest range, alpha **(3)**
(iii) which one is negatively charged. beta **(3)**

Name a detector of radioactivity.
Geiger mueller tube / solid state detector / Wilson cloud chamber **(6)**

Nuclear fission occurs in a nuclear power station.
Name a suitable fuel for nuclear fission.
Uranium 235 **(6)**

Explain the role of neutrons in nuclear fission
Cause fission and chain reaction **(6)**

Explain how the control rods can control the rate of fission, or stop the reaction completely.
Control rods absorb neutrons **(6)**

State two hazards of nuclear power,
Two of: radioactive contamination / radiation waste / mining ore releases radon /
Processing spent fuel rods **(3 + 2)**

and state another example of where nuclear fission occurs.
Sun / Nuclear/atomic bomb **(3)**

QUESTION 11

(a) What is meant by cathode rays?
high speed electrons
(7)

(b) How are electrons liberated from the cathode
Thermionic emission
(7)

(c) Name a suitable metal used as a target in the X-ray tube.
Tungsten
(7)

(d) What happens to the high speed electrons when they hit the metal target?
their energy is converted to X-rays
(7)

(e) X rays are electromagnetic waves. Name two other parts of the electromagnetic spectrum.
Two of: radio waves, microwaves, infra red, visible, ultra violet, gamma rays
(7)

(f) X-rays are used in medicine. Give another use for X-rays.
detect cracks in metal / photograph inside machines / determine thickness of metal sheets / check fullness of packages
(7)

(g) State a way that X-rays can be harmful.
cause skin burns /
cataracts / leukemia / other forms of cancer
genetic defects passed from parents to children
(7)

(h) State how we can be protected from X-rays.
Lead shielding
(7)

QUESTION 12
Answer TWO of the following

(a) State one of the laws of equilibruim

Vector sum of forces in any direction is zero /
The sum of moments about any point is zero
(6)

The diagram shows a metre stick suspended at its centre.
By calculating moments about the 50 cm mark verify that the metre stick is in equilibruim

(anticlockwise) $4 \times 30 = 120$ N cm
(3)
(clockwise) $3 \times 40 = 120$ N cm
(3)
moments equal equilibruim
(3)

If the weight of the metre stick is 2 N find the tension, F, in the supporting string
$F = 4 + 3 + 2 = 9$ N
(6)

Explain why using a spanner with a long handle makes it easier to tighten a nut.
Greater turning moment
(7)

(b) What effect of an electric current does this experiment demonstrate?
Heating effect **(6)**

Name the meter A
Ammeter
(3)

What was the reading on A after the wire broke?
0 Amps
(3)

The fuse is a safety device based on the experiment shown.

Explain how a fuse acts as a safety device.

Large current→fuse melts, circuits breaks

(6)

On which wire should the fuse be placed
Live wire

(3)

Name a device which is often used instead of a fuse,
Circuit breaker / MCB / RCD

(4)

and give an advantage of it over a fuse.
Faster / more sensitive

(3)

(c) What is meant by magnetic field?
Space where magnetic forces can be felt

(6)

Name an instrument used to detect a magnetic field.
Compass needle / magnet

(6)

Describe an experiment to show that a current carrying conductor experiences a force.
Diagram to show: cell, wire, magnet **(3)**
Turn on, wire moves **(3)**
Movement implies force **(3)**

State two factors on which the strength of the force depends.
Two of:
Strength of magnet
Size of current
Length of conductor

(4 + 3)

(d) Distinguish between transverse and longitudinal waves

Transverse: vibration perpendicular to direction of propagation of wave

Longitudinal: vibration parallel to direction of propagation of wave

(9)

The diagram represents a wave.
Copy the diagram and mark in
(i) amplitude,
From centre line to crest

(3)

(ii) wavelength
Full wave to be indicated

(3)

A whistle emits a sound of frequency 6600 Hz.
If the speed of sound in air is 330 m s-1 find the wavelength of the emitted wave

($c = f\lambda \rightarrow 330 = 6600\lambda$

$\lambda = \frac{330}{6600} = 0.05$ metres

(9)

Why would the frequency of the whistle sound higher if you were moving towards it?
Doppler effect

(4)

($c = f\lambda$)

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