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RECOGNISING ACHIEVEMENT

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A332/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
PHYSICS A
Unit 2 Modules P4 P5 P6 (Higher Tier)

TUESDAY 29 JANUARY 2008

Afternoon
Time: 40 minutes

Candidates answer on the question paper.
Additional materials (enclosed):
None

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T42359

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- A list of physics equations is printed on page two.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	**4**	
2	**4**	
3	**5**	
4	**4**	
5	**3**	
6	**4**	
7	**5**	
8	**4**	
9	**4**	
10	**5**	
TOTAL	**42**	

This document consists of **15** printed pages and **1** blank page.

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TWENTY FIRST CENTURY SCIENCE EQUATIONS
Useful Relationships

Explaining Motion

- speed = $\dfrac{\text{distance travelled}}{\text{time taken}}$
- momentum = mass × velocity
- change of momentum = resultant force × time for which it acts
- work done by a force = force × distance moved by the force
- change in energy = work done
- change in GPE = weight × vertical height difference
- kinetic energy = $\dfrac{1}{2}$ × mass × [velocity]^2

Electric Circuits

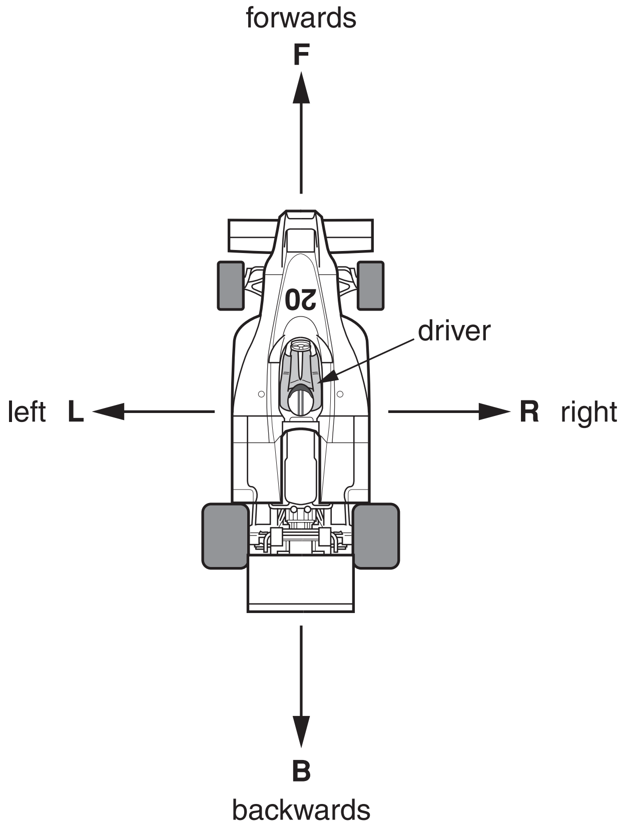
- resistance = $\dfrac{\text{voltage}}{\text{current}}$
- $\dfrac{V_p}{V_s} = \dfrac{N_p}{N_s}$
- energy transferred = power × time
- power = potential difference × current
- efficiency = $\dfrac{\text{energy usefully transferred}}{\text{total energy supplied}}$ × 100%

The Wave Model of Radiation

- wave speed = frequency × wavelength

Answer **all** the questions.

1 A driver in a car experiences forces in different directions as he drives forwards.



(a) **(i)** The car speeds up in a straight line.

Which force, **F**, **R**, **L** or **B**, does the car exert **on the driver**?

answer .... [1]

(ii) The car slows down **and** turns left.

Which two forces, **F**, **R**, **L** or **B**, does the car exert **on the driver**?

.... and .... [2]

(b) The car speeds up in a straight line.

Which force, **F**, **R**, **L** or **B**, does the driver exert **on the car**?

answer .... [1]

[Total: 4]

2 Bobby throws a ball vertically in the air.

(a) The ball weighs 10 N.

(i) How much gravitational potential energy is gained by the ball when it goes up 2.5 m?

Put a ring around the correct answer.

0.04 J **2.5 J** **4 J** **25 J** **40 J** **250 J**

[1]

(ii) At the top of the throw the ball is stationary.

As the ball falls it loses gravitational potential energy, transferring it to kinetic energy.

Which equation correctly shows the velocity of the ball when all the energy has transferred to kinetic energy?

Put a tick (✓) in the correct box.

$$\text{velocity} = \sqrt{\frac{2 \times \text{energy}}{\text{mass}}}$$ ☐

$$\text{velocity} = \frac{\text{energy}}{\text{mass}}$$ ☐

$$\text{velocity} = \sqrt{\text{energy} \times \text{mass}}$$ ☐

$$\text{velocity} = \sqrt{\frac{2 \times \text{energy}^2}{\text{mass}}}$$ ☐

[1]

(iii) The velocity is actually less than that calculated by the equation in part **(ii)**.

Put a tick (✓) in the box next to the best explanation of this.

The mass increases as it falls. ☐

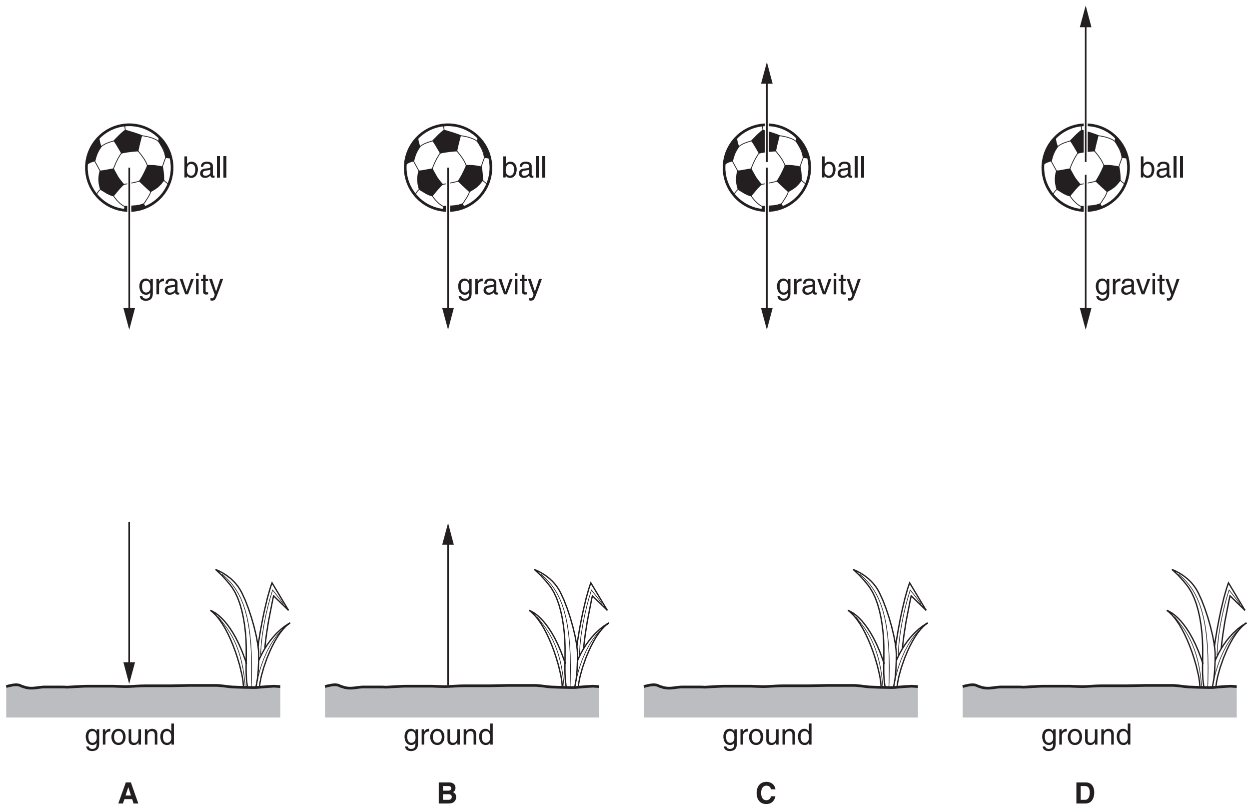
The air resistance increases as it falls. ☐

The momentum increases as it falls. ☐

The energy increases as it falls. ☐

[1]

(b) Gravity is the force pulling the ball down as it falls towards the ground.



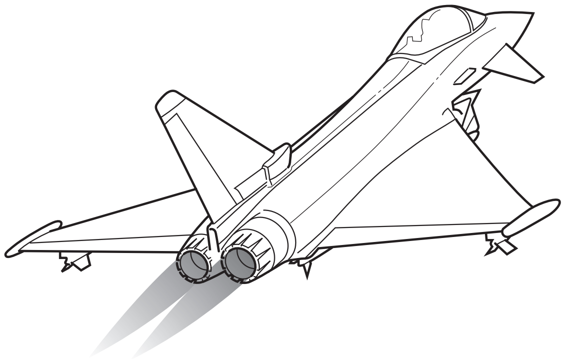
The gravity force is one half of an interaction pair.

Which of these diagrams, **A**, **B**, **C** or **D**, correctly shows both forces of the interaction pair?

answer .... [1]

[Total: 4]

3



A jet plane works by firing a stream of hot exhaust gas particles backwards.

(a) Some of the following statements are true and some are false. Complete the table with either **true** or **false**.

	true or **false**
The force on each gas particle equals the momentum of the jet plane.	
The change in momentum of the exhaust gas particles equals the change in momentum of the plane, ignoring air resistance.	
The force on one gas particle equals the total force on the jet plane.	
The change in momentum of the gas particles equals the force on the plane multiplied by the time for which it acts.	

[2]

(b) Which of the following would be needed to calculate the momentum of the **exhaust gases**?

Put a tick (✓) in each correct box.

mass of a single exhaust gas particle ☐

weight of jet engine ☐

number of exhaust gas particles ☐

velocity of exhaust gas particles ☐

force due to gravity ☐

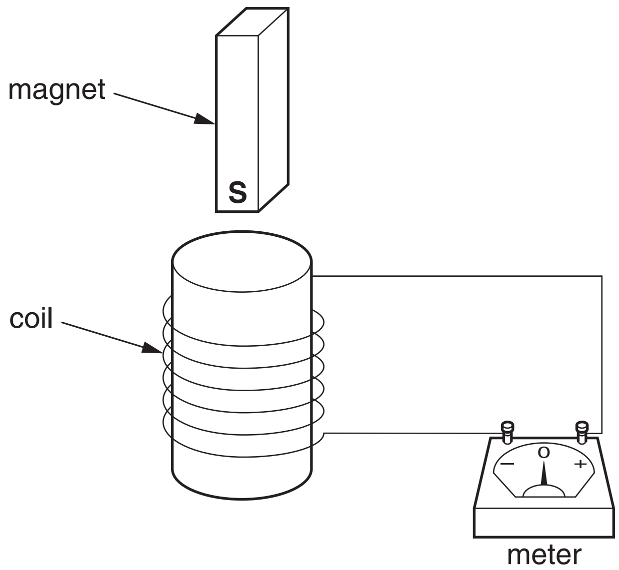
temperature of jet engine ☐

[3]

[Total: 5]

4 Electricity can be generated by moving a magnet in a coil of wire.

The diagram shows a magnet held above a coil of wire.



Experiments with this apparatus can show how the electricity is generated.

(a) Draw a straight line from each **experiment** to **what happens on the meter**.

The first line has been done for you.

experiment

- push the South end of the magnet into the coil
- pull the South end of the magnet out of the coil
- push the North end of the magnet into the coil
- hold the magnet still in the coil

what happens on the meter

- needle flicks to right
- needle does not move
- needle flicks to left

[3]

(b) What is the name for this method of producing a voltage?

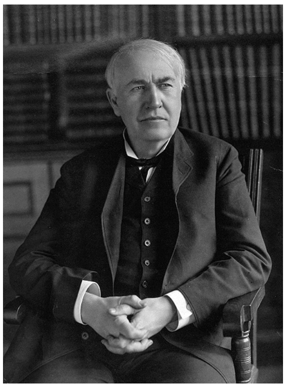
Put a ring around the correct answer.

deduction **induction** **reduction** **transformation**

[1]

[Total: 4]

5



© Wellcome Library, London

Thomas Edison was the first person to set up a company to provide electricity to houses. He used a direct current (d.c.) supply.

(a) We now use an alternating current (a.c.) electricity supply.

Explain why we use a.c. and not d.c.

Put ticks (✓) in the boxes next to the **two** correct explanations.

d.c. is old fashioned	☐
it is easier to generate a.c.	☐
Thomas Edison was unpopular so people would not buy his d.c. electricity	☐
a.c. can be distributed more efficiently	☐
d.c. is more expensive because it can only travel in straight lines	☐

[2]

(b) The main advantage of Thomas Edison's d.c. system was that it used low voltages.

He thought this was safer than a.c.

What is the voltage used for the mains supply to homes in the United Kingdom?

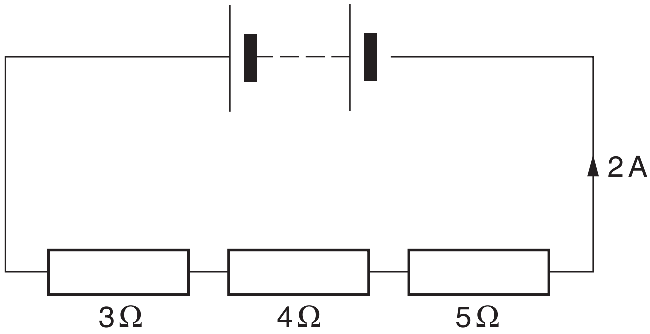
Put a ring around the correct answer.

12V **120V** **230V** **11 000V** **33 000V**

[1]

[Total: 3]

6 This question is about resistors in a series circuit.



(a) What is the voltage across the 3 Ω resistor?

voltage = ... V [1]

(b) Which resistor will have the highest voltage across it?

Put a ring around the correct answer.

3 Ω **4 Ω** **5 Ω** **all the same**

[1]

(c) Which statements describe how to find the voltage across the battery?

Put a tick (✓) in each of the **two** correct boxes.

find the total resistance and divide by the current	☐
add the voltage across each of the resistors together	☐
multiply the voltage across each resistor by its resistance	☐
multiply the current by the total resistance	☐
divide each resistance by the current and add the answers together	☐

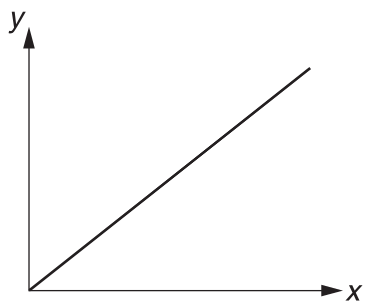
[2]

[Total: 4]

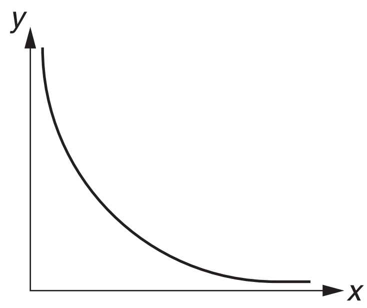
7 Sarah has been doing various electrical tests.

Unfortunately she forgot to label the axes (x and y) on her graphs.

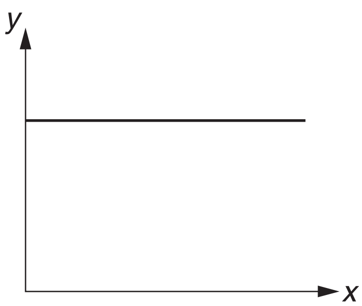
A



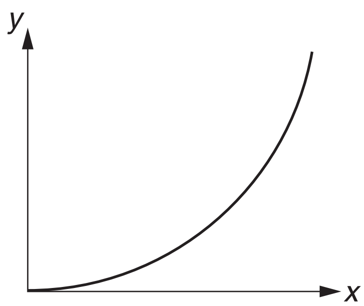
B



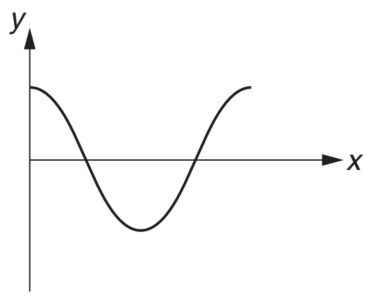
C



D



E



Write down the letter, **A**, **B**, **C**, **D** or **E**, of the graph that best fits each experiment.

Graphs may be used once, more than once or not at all.

(a) How the resistance of an LDR (y) changes with light intensity (x).

answer .... [1]

(b) How the current (y) varies with the voltage (x) when the resistance does not change.

answer .... [1]

(c) How the voltage across the coil of an a.c. generator (y) changes with time (x).

answer .... [1]

(d) How the resistance of a thermistor (y) changes with temperature (x).

answer .... [1]

(e) The brightness of a lamp (y) connected to a battery as the length of the connecting wires (x) is decreased.

answer .... [1]

[Total: 5]

8 Here are different parts of the electromagnetic spectrum.

gamma radiation

infrared

microwaves

radio waves

ultraviolet

visible light

X-rays

(a) Put the parts of the electromagnetic spectrum in order of **increasing wavelength**.

The first one has been done for you.

shortest wavelength	**gamma radiation**
longest wavelength	

[3]

(b) Photons with the highest frequency have the most energy.

Write down the name of the part of the spectrum that has photons with the most energy.

answer .... [1]

[Total: 4]

9 Waves can refract, diffract and interfere.

Each of the observations below can be explained by one of these processes.

Use straight lines to connect each **observation** to its correct **process** and each **process** to its correct **explanation**.

observation	**process**	**explanation**
TV signals received from behind a hill	refraction	waves add as they pass through each other
	diffraction	waves spread out from the edge of a barrier
spectrum formed by a prism	interference	waves change speed at a boundary

[4]

[Total: 4]

10 Hermione reads a passage about transmitting information. The diagrams of waves are missing from the passage.

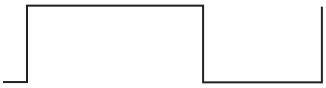
Choose the **best** wave diagram to use for each missing diagram in the passage.

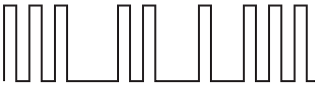
Write down the letter, **A**, **B**, **C**, **D**, **E** or **F**, for each diagram.

Diagrams may be used once, more than once or not at all.

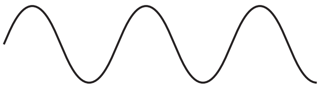
The last one has been done for you.

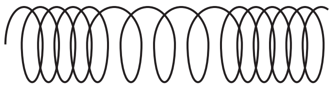
A 

D 

B 

E 

C 

F 

A sound wave is an analogue wave.

diagram …………… [1]

The sound wave is converted into a digital code.

The digital signal is sent as a series of short pulses.

diagram …………… [1]

Digital signals can be transmitted with higher quality than analogue signals.

As the signal is transmitted, it decreases in intensity and picks up noise.

diagram …………… [1]

When the signal is received it is amplified.

diagram …………… [1]

The signal is cleaned up to remove the noise.

diagram …………… [1]

The digital signal is then decoded to reproduce the original sound wave.

diagram ……C……

[Total: 5]

END OF QUESTION PAPER

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