Candidate Name	Centre Number	Candidate Number
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GCSE

241/02

ADDITIONAL SCIENCE

HIGHER TIER

PHYSICS 2

A.M. FRIDAY, 28 May 2010

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark awarded**
1.	**5**	
2.	**10**	
3.	**6**	
4.	**4**	
5.	**8**	
6.	**9**	
7.	**8**	
Total	**50**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

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

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2 of the examination paper. In calculations you should show all your working.

EQUATIONS

Resistance $= \dfrac{\text{voltage}}{\text{current}}$

Power $=$ current $\times$ voltage

Speed $= \dfrac{\text{distance}}{\text{time}}$

Resultant force $=$ mass $\times$ acceleration

Acceleration $= \dfrac{\text{change in speed}}{\text{time}}$

Force $= \dfrac{\text{Work done}}{\text{distance}}$

Kinetic Energy $= \dfrac{\text{mass} \times \text{speed}^2}{2}$

$= \frac{1}{2}\, mv^2$

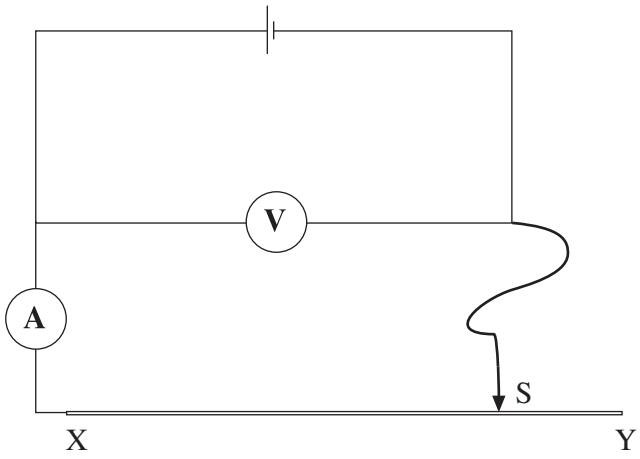
Change in potential energy $=$ mass $\times$ gravitaional field strength $\times$ change in height

$= mgh$

Answer **all** *questions in the spaces provided.*

1. The following circuit shows an ammeter (A) and a voltmeter (V) connected to a power supply and a resistance wire XY.

A connector, S, allows the length of wire in the circuit to be changed.



(a) With S in the position shown, the voltmeter reads 6 V and the ammeter 1.2 A. Use the equation

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

to calculate the resistance of the wire between X and S. [2]

Resistance = ... Ω

(b) The connector S is moved towards Y. State the effect, **if any** this would have on:

(i) the resistance in the circuit; .....

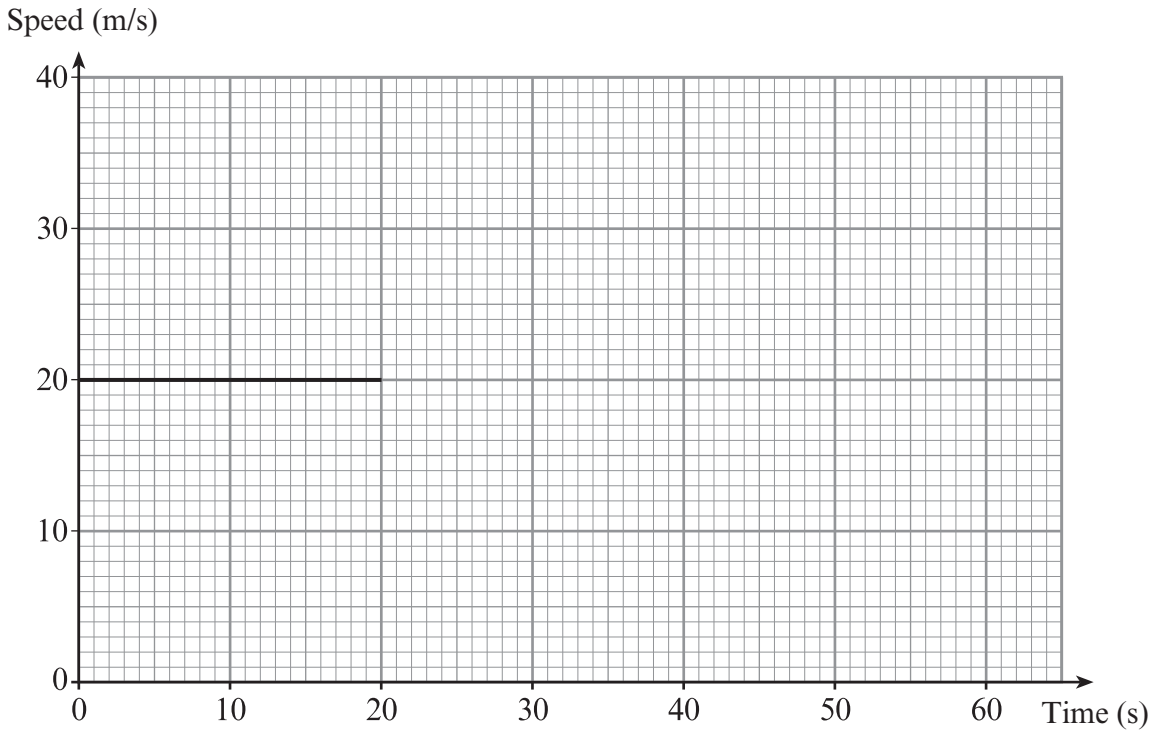
(ii) the ammeter reading; .....

(iii) the voltmeter reading. .....

[3]

Examiner only

2. The graph shows the first 20 s of the motion of a van already moving at a constant speed.



At 20 s the driving force is increased and the van accelerates for 20 s to reach a new constant speed of 30 m/s. The van continues at this new constant speed for a further 20 s.

(a) Complete the graph to show the motion of the van between 20 s and 60 s. [2]

(b) Write down an equation from page 2 and use it to calculate the average acceleration of the van during the period when it is accelerating.

Equation: .....

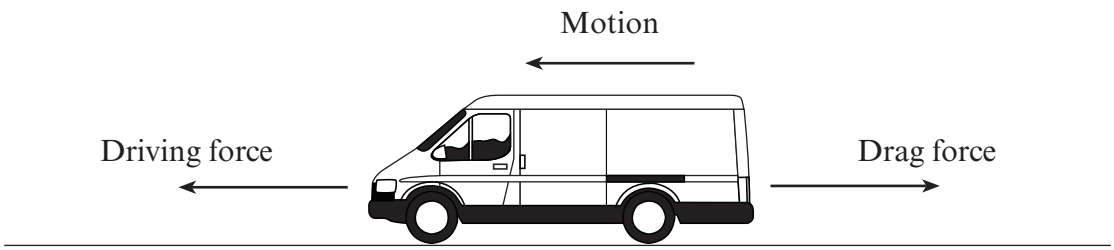
.....

[1]

Calculation: [2]

Acceleration = ... m/s^2

(c) The diagram shows the horizontal forces acting on the van.



The driving force is 1000 N between 0 and 20 s. The mass of the van is 2400 kg.

(i) Between 0 and 20 s, the drag force on the van is also 1000 N.
Explain clearly why this must be the case. [2]

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.....

.....

(ii) Use the equation

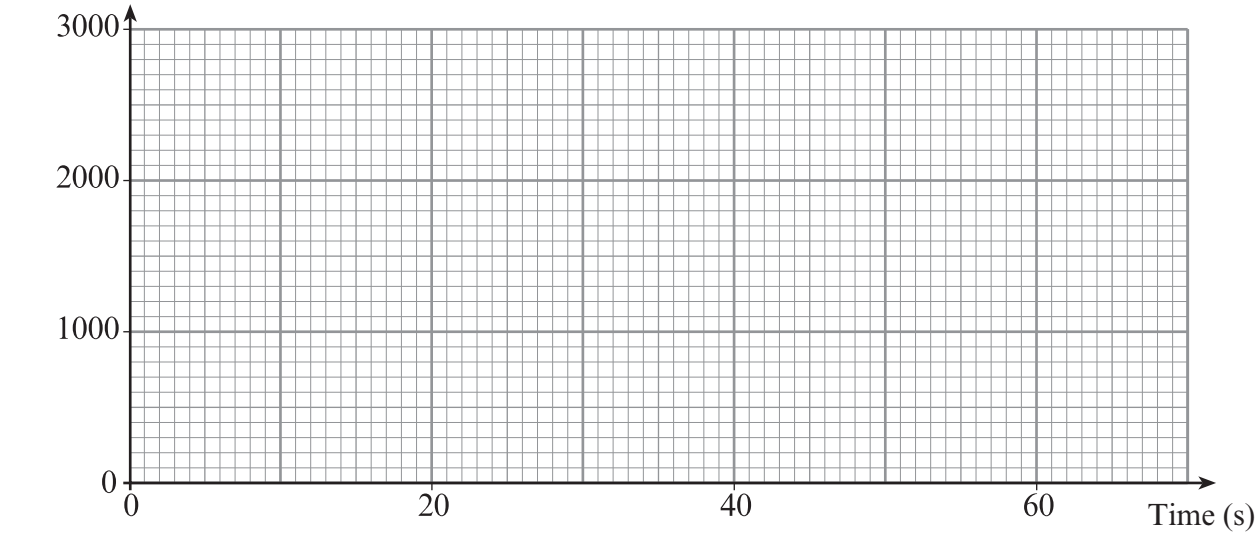
Resultant force = mass × acceleration

to calculate the average resultant force on the van between 20 s and 40 s. [1]

Resultant force = ... N

Examiner only

(d) On the grid below, sketch a graph to show how the resultant force on the van changes between 0 and 60 s. [2]



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Examiner only

3. Read the passage carefully before answering the questions.

Radiotherapy is a branch of medicine used for the treatment of cancerous tumours.

External radiotherapy uses a powerful gamma emitter which is heavily shielded. The gamma-ray beam is aimed at the tumour for short periods of time from different directions. This allows the tumour to receive the largest possible amount of radiation without doing much damage to healthy cells around it. The tumour cells are killed by absorbing large amounts of heat from the energy of the radiation.

Internal radiotherapy is generally used for tumours which are easy to locate. It is carried out by inserting a small radioactive source, which has a short $\frac{1}{2}$-life, directly into the tumour. The radiation emitted by the source destroys the tumour from the inside. Healthy cells around the tumour suffer little damage. Internal radiotherapy is less dangerous for the patient and is generally more effective than external radiotherapy.

(i) Give **two** reasons why the gamma-ray beam in external radiotherapy is directed at the tumour for short periods of time from different directions. [2]

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(ii) What precaution is taken to protect the patient and radiotherapist in external radiotherapy? [1]

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(iii) Explain why internal radiotherapy is considered to be more effective than external radiotherapy. [2]

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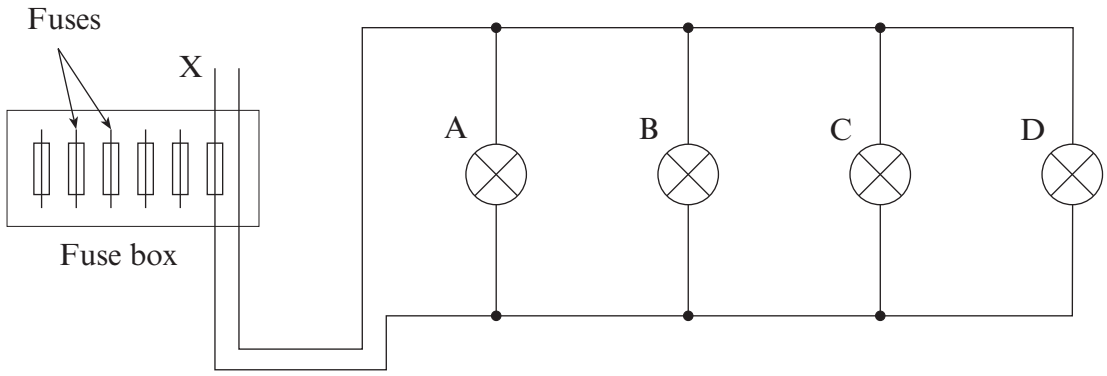
(iv) A patient receives an implant of 200 units of Iodine-131 directly into a thyroid-gland tumour. After 8 days, the activity of the implant falls to 100 units.

Calculate the activity of the implant 32 days after it was placed in position. [1]

Activity = ... units

Examiner only

4. The diagram shows part of a mains lighting circuit protected by a fuse in the mains fuse box (consumer unit). A, B, C and D are lamps in the circuit.



(a) How does the diagram show that lead X is the live lead? [1]

.....

.....

(b) Add to the circuit in a **correct and safe position**

(i) a switch labelled S_1 which controls lamp A only;

(ii) a switch labelled S_2 which controls lamps C and D only. [3]

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5. *(a)* A 2 kW lawnmower is operated on a 230 V mains supply.
Write down an equation from page 2 and use it to calculate the current drawn from the mains supply.

Equation: .....

.....

[1]

Calculation: [3]

Current = ... A

(b) The earth wire and fuse in the plug together provide some protection for users of the lawnmower. Manufacturers however, recommend that a residual current device (r.c.d.) be used in the lawnmower circuit to provide additional protection for the user.

(i) Explain how an r.c.d. works. [2]

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(ii) Give **two** reasons why the r.c.d. gives **greater protection** than the earth wire and fuse. [2]

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8

Examiner only

6. The normal level of background radiation in a storage bunker for radioactive materials is 50 count / minute. Because of a spillage of radioactive material the count rate in the bunker became 850 count / minute.

(a) Calculate the count rate produced by the leaked material. [1]

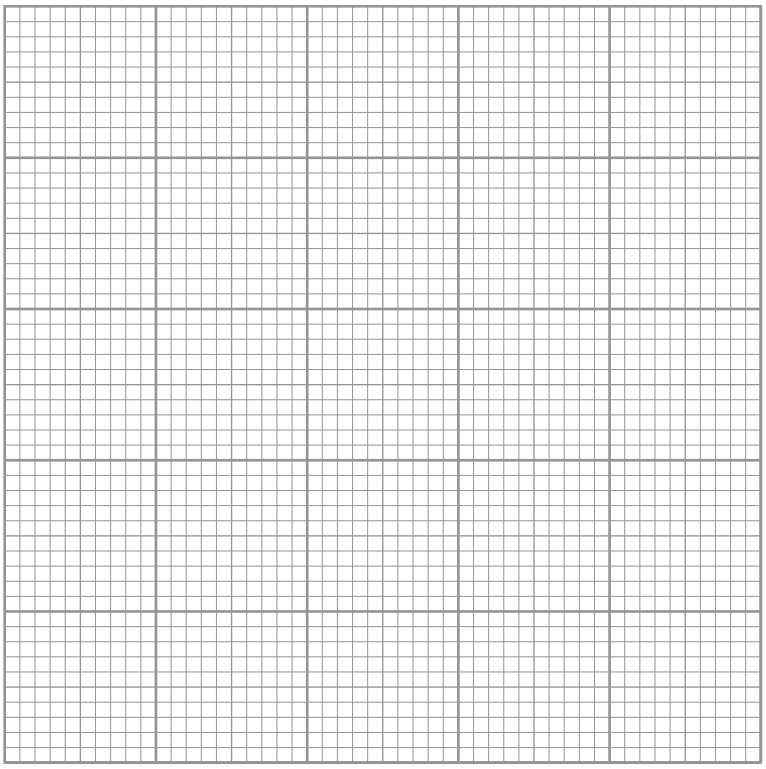
Count rate = ... count / minute

(b) The leaked material has a $\frac{1}{2}$-life of 10 days.

(i) Complete the table to show how the activity **of the leaked material** changes over time.

Activity (count / minute)					
Time (days)	0	10	20	30	40

(ii) Select suitable scales and plot a decay curve for the leaked material. [3]



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(c) (i) Use the graph to estimate the reading that a count-rate detector, placed in the storage bunker, would give after 15 days. [2]

Count rate = ... count/min

(ii) The bunker can only be safely entered when the count rate detector gives a reading of less than $2\frac{1}{2}$ × the normal background reading, or less.
Determine how long after the spillage it would be safe to enter the bunker.
Show your working and how you used your graph to arrive at your answer. [3]

Time = ... days

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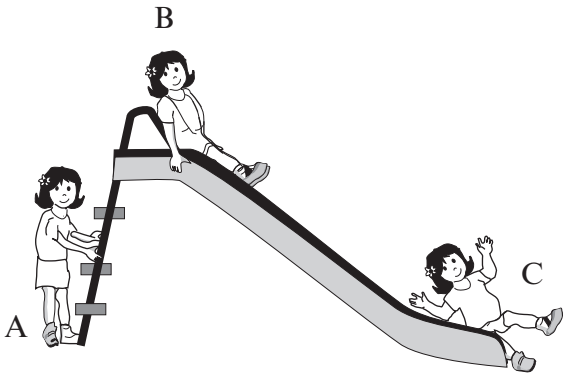
Examiner only

7.



A child of mass 30 kg at A climbs to the top of a playground slide B and slides down to C.

At the top of the slide the child has gained 937.5 J of gravitational potential energy. 60% of this energy is lost as heat in sliding down to C.

(a) Use the equations:

Potential energy = mgh

Kinetic energy = $\frac{1}{2}mv^2$

where
m = mass
g = gravitational field strength = 10 N/kg
h = height
v = speed

to calculate

(i) the height, h, of the slide [2]

h = ... m

(ii) the kinetic energy of the child at C [2]

kinetic energy = ... J

Examiner only

(iii) the speed, v, of the child at C. [2]

$v =$ ..... m/s

(b) Explain why energy is lost as heat when the child slides from B to C. [2]

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