

Edexcel IGCSE

Double Award 4437

November 2006

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Mark Scheme

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IGCSE SCIENCE (DOUBLE AWARD) 4437, MARK SCHEME

Key

- ; indicates separate mark points
- / indicates alternatives
- eq allow for correct equivalent
- word underlined means no alternatives allowed

Paper 1F

1. (a) C;
(b) C;
(c) D;
(d) B;
(e) A;
(f) D;
(g) C; (7)

Total 7 marks

2. (a) high milk yield;
quality of milk;
high meat production / fast growth / large; max
lean meat; (2)
non-aggressive;
- (b) (humans) choose animals to breed / use the best; (1)

Total 3 marks

3. (a) A - left ventricle; (2)
B - tricuspid / AV valve / valve;
- (b) arrow into the right atrium;
arrow out of the right ventricle through the pulmonary artery; (2)
- (c) close;
stop backflow of blood; (2)
- (d) more oxygen; oxygenated / brighter red;
less carbon dioxide; max
greater pressure; (2)

Total 8 marks

4. (a) (i) water; (1)
(ii) light / sun; (1)

- (b) (i) ✓ x / ✓;
x ✓;
✓ x;
x ✓; (4)

- (ii) magnesium; making chlorophyll;
OR nitrate; making amino acids / protein;
OR potassium; enzyme action;
OR calcium; cell walls;
OR phosphate; ATP; (2)

Total 8 marks

5. (a) reproductive system; (1)

- (b) (i) B – ureter;
C – urethra;
D – bladder; (3)

- (ii) water;
urea;
salts; (2)

- (c) skin;
lungs; (2)

Total 8 marks

6. (a) idea of amount / quantity; (1)

- (b) (i) A; (1)

- (ii) both increase yield;
herbicide more than pesticide;
fewer pests to eat crop; max
fewer weeds to compete for water / eq; (2)

Total 4 marks

7. (a) (i) pancreas;
small intestine; ileum; (2)

- (ii) pancreas secretes (digestive) enzymes / secretes insulin;
small intestine secretes (digestive) enzymes / where
(digested) food is absorbed (2)

- (b) lipase works best with bile;
(lipase works) least well in acidic solution /
better in alkaline conditions;
bile is alkaline / neutralises / optimum Ph / eq;
bile emulsifies fat;
larger surface area; max
denature / affect active site; (4)

Total 8 marks

8. lens;
changes shape;
rays need to converge / meet on the retina;
more convex / fatter to see near objects;
rays bent more when viewing near objects;
less convex / thinner when seeing distant objects;
rays bent less when viewing distant objects;

**max
(5)**

Total 5 marks

9. (a) two; **(1)**
- (b) N n N n;
Nn Nn NN nn;
no no no yes; **(3)**
- (c) (i) nucleus / chromosome; **(1)**
(ii) DNA; **(1)**

Total 6 marks

10. (a) correct chain;
chain in the correct direction (arrows); **(2)**
- (b) voles increase;
fewer weasels eating them / less eaten fewer predators / eq;
owls increase;
more voles / more small birds / more food / less competition; **(4)**
- (c) (i) voles, small birds or beetles; **(1)**
(ii) producers; **(1)**
(iii) producers are few / trees are few / one tree;
producers are heavy / trees are heavy / have lots of mass /
bigger / larger; **(2)**
- (d) leaching / soil erosion / patterns of rainfall; **(1)**

Total 11 marks

11. (a) Cut / eq;
Sterilise / disinfect;
nutrient / agar / food / medium / growth substance / glucose /
minerals;
roots / leaves; IGNORE water **(4)**
- (b) genetically / alleles / genes / DNA;
identical / same; **(2)**
- (c) quicker;
all plants produce drug / less variation idea / identical;
lots made / commercial idea; **max
(1)**

Total 7 marks

PAPER TOTAL 75 MARKS

Paper 2F

1. (a) water / moisture (1)
oxygen / air (1)

- (b) galvanising: bucket / car body (1)
oiling: bicycle chain (1)
painting: car body / bridge (1)

Total 5 marks

2. (a) chromatography (1)
filtration (1)
distillation (1)

- (b) boiling point / freezing point (1)
100°C / 0°C (1)

Total 5 marks

3. (a) (i) cryolite (1)
(ii) high melting point / conducts electricity (1)
(iii) oxygen (1)
carbon dioxide / carbon monoxide (1)

- (b) aluminium: drink cans, aeroplanes, cooking foil, any other suitable (1)

Total 5 marks

4. (a) nucleus (1)

- (b) electron (1)

- (c) electron (1)

- (d) (i) 18 (1)

23 (1)

19 (1)

17 (1)

- (ii) W & Z (1)

X & W or Z (1)

- (iii) 2.8.1 (1)

- (e) 7 (1)

Total 11 marks

5. (a) (i) ticks next to: bitumen (1)
gasoline (1)
kerosene (1)
(ii) fractional (1)
distillation (1)
- (b)
$$\begin{array}{c} \text{H} & & \text{H} \\ & \backslash & / \\ & \text{C} = \text{C} \\ & / & \backslash \\ \text{H} & & \text{H} \end{array}$$
 (1)
- (c) orange / brown (1)
to colourless (1)
- (d) (i) poly(ethene) (1)
(ii) e.g. bags, buckets (any suitable use) (1)

Total 10 marks

- | | | | |
|-----------|-----|-------------------------------------|------------|
| 6. | (a) | second and last boxes ticked | (2) |
| | (b) | (i) green solid left / no fizzing | (1) |
| | | (ii) to remove copper(II) carbonate | (1) |
| | | (iii) copper(II) sulphate | (1) |
| | | water | (1) |
| | | NB (II) not essential | |
| | (c) | (i) white | (1) |
| | | to blue | (1) |
| | | (ii) reversible | (1) |

Total 9 marks

- | | | | | |
|-----------|-----|-------|--------------------------------|------------|
| 7. | (a) | (i) | sodium chloride | (1) |
| | | (ii) | electrolysis | (1) |
| | | (iii) | making soap / paper / ceramics | (1) |
| | (b) | | green / yellow-green | (1) |
| | (c) | (i) | white / colourless | (1) |
| | | (ii) | bleach / oxidising agent | (1) |
| | | (iii) | blue | (1) |
| | | (iv) | alkali / alkaline / alkalinity | (1) |

Total 8 marks

8. (a) (i) only single bonds / no more atoms can be added (1)
 (ii) (they contain) carbon and hydrogen only (1)
- (b) (i) C_nH_{2n+2} (1)
 (ii) alkanes (1)
 (iii) similar chemical properties
 gradation in physical properties
 neighbouring members differ by CH_2 } any two (2)
- (c) (compounds with) the same molecular formula (1)
 (but) different structures / structural formula (1)

Total 8 marks

9. (a) Na^+ (1)
 (b) O^{2-} (1)
 (c) Cl^- (1)
 (d) Mg (1)
 (e) Mg^{2+} , Na^+ and O^{2-} (1)

Total 5 marks

10. (a) (i) enthalpy change / energy change / heat change (1)
 (ii) reaction is exothermic / heat is given out (1)
- (b) $H \overset{\times}{\underset{\cdot}{\cdot}} H$ (1)
- (c) forces between molecules (determine boiling point) (1)
 (these are) weak (1)
- (d) (i) silver nitrate (1)
 (ii) white precipitate (1)
 (iii) $AgNO_3$ (on left) (1)
 $AgCl$ and HNO_3 (on right) (1)

Total 9 marks

TOTAL FOR PAPER 75 MARKS

Paper 3F

Question 1

Qu part	Answer	Extra information	Mark
(a)	distance time		1
(b)(i)	B and D		1
(ii)	C		1
(iii)	A	E	1
(c)	ANY THREE:		1
	going backwards	reverse direction	
	same speed as A	4 m/s	1
	ends up back at start	- 4 m/s score 1 st 2 marks	1
	constant speed	constant velocity	

(Total 7 marks)

Question 2

Qu part	Answer	Extra information	Mark
(a)(i)	chemical		1
	electrical		1
(ii)	electrical		1
	heat		1
(iii)	voltage	potential difference	1
	resistance	resistor/other components	1
(b)(i)	three points plotted to within ½ mm	-1 for each misplot up to a maximum of two	2
	smooth curve		1
(ii)	34.5 °C	credit response in range 34 °C – 36 °C	1
(iii)	below		1

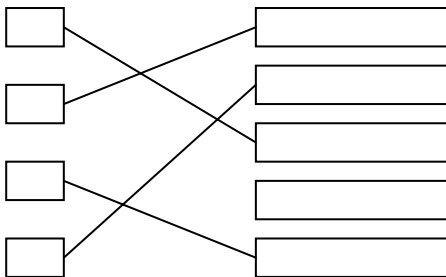
(Total 11 marks)

Question 3

Qu part	Answer	Extra information	Mark
(a)	point		1
	weight		1
(b)(i)	centre of gravity higher	X is higher	1
	X (horizontally) nearer to A	X on other side of A	1
(ii)	pot : wider/shallower/thicker base		1
(iii)	stove : wider		1

(Total 6 marks)

Question 4

Qu part	Answer	Extra information	Mark
(a)		ignore whatever may be written in the boxes above unless no lines are drawn then refer to the boxes for possible credit	1 1 1 1
(b)	G		1
(c)	cancer	mutations	1
(d)	heating	night vision	1

(Total 7 marks)

Question 5

Qu part	Answer	Extra information	Mark
(a)	8		1
	9		1
	8		1
(b)	beryllium/Be	both and no other(s)	1
(c)	unstable		1
	random		1

(Total 6 marks)

Question 6

Qu part	Answer	Extra information	Mark
(a)	decreases	reduces / lessens or words to that effect	1
(b)	becquerel		1
(c)(i)	tracer		1
(c)(ii)	4 hours		1
(iii)	4 s : too short to get information		1
	4 y : stays active (in body) too long		1

(Total 6 marks)

Question 7

- | | | | |
|-----|--|---|---|
| (a) | centre of X vertically below the rope and in the body of the sack | allow a dot rather than the centre of X if X is positioned near to it | 1 |
| (b) | (static) friction | allow upward force/supporting (force)/reaction (force) | 1 |
| (c) | 500 (N)
or 495 (N) or 490 (N) | Or (weight=) 50×10
Or 50×9.81 or 50×9.8 | 1 |
| (d) | ...force/weight ...distance/length | both in correct order | 1 |

(Total 5 marks)

Question 8

- | | | | |
|----------|---|---|---|
| (a)(i) | (in) parallel | | 1 |
| (a)(ii) | can be switched on (and off) separately | dop
otherwise they would all be switched together/ they are like the lights in a house OWTTE | 1 |
| (a)(iii) | 1 / one | | 1 |
| | 8 / eight | | 1 |
| (b)(i) | <u>variable</u> resistor / <u>variable</u> resistance / rheostat / resistance box | Not 'resistor' | 1 |
| (b)(ii) | use/ adjust X / (variable) resistor | remove or increase resistance scores 0 | 1 |
| | to reduce resistance | scores both marks | 1 |

(Total 7 marks)

Question 9

(a)	(triangular) prism	not rectangular	1
(b)(i)	line from top prism down centre of periscope tube reflected from back surface of bottom prism	allow minor imperfections if the intention is clear	1
(b)(ii)	<u>total internal reflection</u>		1
(c)(i)	line from top mirror down centre of periscope tube reflected from centre of bottom mirror	allow minor imperfections if the intention is clear	1
(c)(ii)	reflection	not 'total internal reflection' accept 'partial reflection'	1
(c)(iii)	(plane) mirror		1

(Total 6 marks)

Question 10

(a)(i)	E		1
(a)(ii)	line from watch down centre of tube reflected from surface up centre of tube <u>E</u>	allow minor imperfections if the intention is clear	1
	correct direction indicated	need not show more than one arrow but do not credit if more than one shown and they contradict <i>if (i) is incorrect can score 2nd mark in (ii)</i>	1
(b)	reflected		1
	...incidence...reflection	both required in either order	1
(c)	to block out the (other) sound	OWTTE	1
	coming (directly) from the watch	dop 'which could distract/confuse' 'which would be louder than tube A'	1

(Total 7 marks)

Question 11

- | | | | |
|-----|-----------|---|----------|
| (a) | increases | | 1 |
| (b) | weight | or gravity/gravitational | 1 |
| (c) | friction | not air friction | 1 |
| (d) | decreases | or returns to normal/atmospheric (pressure) | 1 |
| (e) | increase | faster/ more kinetic energy | 1 |

(Total 5 marks)

Paper 4H

1. (a) (i) pancreas; (2)
small intestine; ileum;
(ii) pancreas secretes (digestive) enzymes / secretes insulin;
small intestine secretes (digestive) enzymes / where
(digested) food is absorbed (2)

- (b) lipase works best with bile;
(lipase works) least well in acidic solution / better in alkaline
conditions;
bile is alkaline / neutralises / optimum Ph / eq; max
bile emulsifies fat; (4)
larger surface area;
denature / affect active site;

Total 8 marks

2. lens;
changes shape;
rays need to converge / meet on the retina;
more convex / fatter to see near objects;
rays bent more when viewing near objects;
less convex / thinner when seeing distant objects; max
rays bent less when viewing distant objects; (5)

Total 5 marks

3. (a) two; (1)
(b) N n N n;
Nn Nn NN nn;
no no no yes; (3)
(c) (i) Nucleus / chromosomes; (1)
(ii) DNA; (1)

Total 6 marks

4. (a) correct chain;
chain in the correct direction (arrows); (2)
(b) voles increase;
fewer weasels eating them / less eaten fewer predators / eq;
owls increase;
more voles / more small birds / more food / less competition; (4)
(c) (i) voles, small birds or beetles; (1)
(ii) producers; (1)
(iii) producers are few / trees are few / one tree;
producers are heavy / trees are heavy / have lots of mass /
larger / bigger; (2)
(d) leaching / soil erosion / patterns of rainfall; (1)

Total 11 marks

5. (a) cut / eq;
sterilise / disinfect;
nutrient / agar / food / medium / growth substance / glucose / minerals;
roots / leaves; IGNORE water (4)
- (b) genetically / alleles / genes / DNA;
identical / same; (2)
- (c) quicker;
all plants produce drug / less variation idea / identical;
lots made / commercial idea; max (1)

Total 7 marks

6. (a) digested / broken down;
peptides; polypeptides; amino acids;
enzyme / protease / pepsin;
HCl;
optimum / best / most suitable pH; max (3)
- (b) (i) increases + decreases;
peaks at 32 / correct reference to numbers; (2)
(ii) 2 700; (1)
- (c) less predation;
less heat loss / less energy loss;
less movement idea;
control of food quantity / quality / conditions;
more energy for growth; max
less likely to contract disease; (2)

Total 8 marks

7. (a) (i) correct heights at rest + exercise;;
axes correct and labelled; (4)
key to distinguish rest and exercise;
(ii) 84 000; (1)
(iii) 300;; 500 – 2000 **or** 1500 divided by 500; (2)
- (b) (i) arterioles / (small) arteries; max
widen / dilate / expand / vasodilation; (2)
muscles relax;
(ii) heat loss; max
radiation / convection; (2)
lower body temperature / keep at 37°C / optimum / cools down;
(iii) glucose / oxygen;
respiration;
energy / ATP;
muscle contraction / shortening;
removes CO₂ / lactic acid; max
less anaerobic respiration; (2)

Total 13 marks

8. (a) (i) 11 300; (1)
(ii) 5 100; (1)

(b) testosterone: develop male secondary sexual characteristics / eq;
progesterone: maintain uterus lining / inhibit FH/FSH; (2)

(c) controls what goes in and out/allow molecules in and out eq.; (1)

Total 5 marks

9. (a) increase yield / grow more / grow faster;
increase photosynthesis;
enzymes; (3)

(b) start at one week;
line going down and to the left of *Encarsia* line;
line going very low (below 10); max
line then going back up; (2)

(c) no resistance; IGNORE immune
no collateral damage to other species / food chains / specific;
keeps pests low;
no reintroduction / reapplication needed / long lasting;
less pollution / no harm to environment; max
(3)

Total 8 marks

10. (a) (human) gene / DNA (for insulin);
plasmid / vector;
restriction enzyme;
same restriction enzyme;
cuts / eq;
ligase; max
sticks / eq; (5)

(b) (i) pancreas / Islets of Langerhans; (1)
(ii) controls / regulates sugar / glucose levels;
reduces glucose;
converts to glycogen; max
in liver; (3)

Total 9 marks

11. (a) (i) pituitary; (1)
(ii) blood / eq; (1)
(iii) collecting duct; (1)

(b) no / less reabsorption less water into blood / blood more
concentrated;
dehydration / loses too much water; (2)

(c) drink (lots of) water;
ACCEPT ADH tablets / injection (1)

Total 6 marks

- 12.** nitrifying;
denitrifying;
nitrogen fixing;
decomposing / decomposers;

(4)

Total 4 marks

PAPER TOTAL 90 MARKS

Paper 5H

1. (a) (i) sodium chloride (1)
(ii) electrolysis (1)
(iii) making soap / paper / ceramics (1)
- (b) green / yellow-green (1)
- (c) (i) white / colourless (1)
(ii) bleach / oxidising agent (1)
(iii) blue (1)
(iv) alkali / alkaline / alkalinity (1)

Total 8 marks

2. (a) (i) only single bonds / no more atoms can be added (1)
(ii) (they contain) carbon and hydrogen only (1)
- (b) (i) C_nH_{2n+2} (1)
(ii) alkanes (1)
(iii) similar chemical properties
gradation in physical properties
neighbouring members differ by CH_2 } *any two* (2)
- (c) (compounds with) the same molecular formula (1)
(but) different structures / structural formula (1)

Total 8 marks

3. (a) Na^+ (1)
- (b) O^{2-} (1)
- (c) Cl^- (1)
- (d) Mg (1)
- (e) Mg^{2+} , Na^+ and O^{2-} (1)

Total 5 marks

4. (a) (i) enthalpy change / energy change / heat change (1)
(ii) reaction is exothermic / heat is given out (1)
- (b) $H \begin{matrix} \times \\ \cdot \end{matrix} H$ (1)
- (c) forces between molecules (determine boiling point) (1)
(these are) weak (1)
- (d) (i) silver nitrate (1)
(ii) white precipitate (1)
(iii) $AgNO_3$ (on left) (1)
 $AgCl$ and HNO_3 (on right) (1)

Total 9 marks

5. (a) (i) solid (1)
 (ii) 25 to 100 °C (1)
- (b) (i) -1 (1)
 (ii) each need to gain one electron (1)
 to get full outer energy level / shell (1)
- (c) fluorine (1)
- (d) (i) $\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$ (1)
 reagents and products (1)
 balancing (1)
 (ii) solution becomes red / orange / brown / yellow (1)
- (e) $\text{K}: \frac{16.4}{39} = 0.421$; $\text{Cl}: \frac{30.0}{35.5} = 0.845$; $\text{I}: \frac{53.6}{127} = 0.422$ (1)
 simplification of ratio / dividing all by 0.421 i.e. K =1; Cl = 2; I = 1 (1)
 correct formula: KCl_2I (1)

Total 12 marks

6. (a) (i) needs lots of energy / container would melt (1)
 (ii) cryolite has a lower melting point (1)
 aluminium oxide dissolves in molten cryolite (1)
OR
 mixture of aluminium oxide and cryolite (1)
 has lower melting point (1)
- (b) $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$ (1)
 species correct (1)
 balanced (1)
- (c) O^{2-} / oxide (1)
 lost electrons (1)
- (d) carbon / graphite (electrode) (1)
 reacts with oxygen formed (1)
 makes carbon dioxide / carbon monoxide (1)

Total 10 marks

7. (a) no more bubbles (1)
- (b) (i) 138 (1)
(ii) $2.76 \div 138 = 0.02$ (moles) (1)
(iii) 44 (1)
(iv) $44 \times 0.02 = 0.88$ (g) (1)
(v) $0.02 \times 24 = 0.48$ (dm³) (1)
- (c) (i) flame test / description of flame test (1)
lilac (1)
(ii) add dilute hydrochloric acid
test gas with acidified K₂Cr₂O₇ / (damp) blue litmus
orange to green / goes red
NB If no test, can score last mark by stating SO₂ produced
OR
add barium chloride (1)
followed by hydrochloric acid (1)
white precipitate which dissolves on adding hydrochloric acid (1)

Total 11 marks

8. (a) (refinery) gases (1)
- (b) (i) high temperature / alumina catalyst (1)
(ii) fractional distillation of crude oil produces more long chain fractions than required (1)
- (c) exothermic (1)
- (d) (i) $2\text{CH}_4 + 3\text{O}_2 \rightarrow 2\text{CO} + 4\text{H}_2\text{O}$ (accept equation to produce C) (1)
all reagents and products correct = 1 (1)
balancing = 1 (1)
(ii) CO poisonous / toxic (1)
reduces ability of blood to carry oxygen / correct reference to haemoglobin (1)

Total 8 marks

9. (a) (i) natural gas / oil **NOT** methane (1)
(ii) $\text{H}_2\text{O} + \text{CH}_4 \rightarrow \text{CO} + 3\text{H}_2$ (1)
correct species (1)
balancing (1)
ALLOW correct equation producing hydrogen from cracking
(iii) iron (1)
- (b) (i) forward and reverse reactions take place (1)
same rate / concentrations do not change (1)
(ii) more / increases (1)
(iii) less / decreases (1)
- (c) (i) acid rain (1)
(ii) kills trees
kills fish
damages buildings } any two (2)

Total 11 marks

- 10.** (a) Each C bonded to 4 others (1)
arranged tetrahedrally (1)
each C held rigidly in place/strong bonds need to be broken to (1)
deform structure
- (b) Each C bonded to 3 others (1)
arranged in layers of hexagons (1)
weak forces between layers/layers can slide over each other (1)
- (c) strong (covalent) bonds (between atoms) (1)
need lots of energy to overcome/break (1)

Total 8 marks

PAPER TOTAL 90 MARKS

Paper 6H

Question 1

- | | | | |
|-----|--|---|---|
| (a) | centre of X vertically below the rope and in the body of the sack | allow a dot rather than the centre of X if X is positioned near to it | 1 |
| (b) | (static) friction | allow upward force/supporting (force)/reaction (force) | 1 |
| (c) | 500 (N)
or 495 (N) or 490 (N) | Or (weight=) 50×10
Or 50×9.81 or 50×9.8 | 1 |
| (d) | ...force/weight ...distance/length | both in correct order | 1 |

(Total 5 marks)

Question 2

- | | | | |
|----------|---|---|---|
| (a)(i) | (in) parallel | | 1 |
| (a)(ii) | can be switched on (and off) separately | dop
otherwise they would all be switched together/ they are like the lights in a house OWTTE | 1 |
| (a)(iii) | 1 / one | | 1 |
| | 8 / eight | | 1 |
| (b)(i) | <u>variable</u> resistor / <u>variable</u> resistance / rheostat / resistance box | Not 'resistor' | 1 |
| (b)(ii) | use/ adjust X / (variable) resistor | remove or increase resistance scores 0 | 1 |
| | to reduce resistance | scores both marks | 1 |

(Total 7 marks)

Question 3

(a)	(triangular) prism	not rectangular	1
(b)(i)	line from top prism down centre of periscope tube reflected from back surface of bottom prism	allow minor imperfections if the intention is clear	1
(b)(ii)	<u>total internal reflection</u>		1
(c)(i)	line from top mirror down centre of periscope tube reflected from centre of bottom mirror	allow minor imperfections if the intention is clear	1
(c)(ii)	reflection	not 'total internal reflection' accept 'partial reflection'	1
(c)(iii)	(plane) mirror		1

(Total 6 marks)

Question 4

(a)(i)	E		1
(a)(ii)	line from watch down centre of tube reflected from surface up centre of tube <u>E</u>	allow minor imperfections if the intention is clear	1
	correct direction indicated	need not show more than one arrow but do not credit if more than one shown and they contradict <i>if (i) is incorrect can score 2nd mark in (ii)</i>	1
(b)	reflected		1
	...incidence...reflection	both required in either order	1
(c)	to block out the (other) sound	OWTTE	1
	coming (directly) from the watch	dop 'which could distract/confuse' 'which would be louder than tube A'	1

(Total 7 marks)

Question 5

- | | | | |
|-----|-----------|---|---|
| (a) | increases | | 1 |
| (b) | weight | or gravity/gravitational | 1 |
| (c) | friction | not air friction | 1 |
| (d) | decreases | or returns to normal/atmospheric (pressure) | 1 |
| (e) | increase | faster/ more kinetic energy | 1 |

(Total 5 marks)

Question 6

- | | | | |
|---------|---|-------------------------------------|---|
| (a) | $a = F/m = 150 / 600$ | | 1 |
| | $= \underline{0.25}$ | | 1 |
| | m/s^2 | | 1 |
| (b)(i) | weight - downwards | gravitational pull/force gravity(0) | 1 |
| | air resistance - upwards | drag / air friction upthrust (0) | 1 |
| (b)(ii) | upward force = downward force / no unbalanced force | | 1 |
| | no acceleration | | 1 |
| (c)(i) | 0 – 20 s : zero | | 1 |
| | 20 – 40 s : $0.4 / 20$ | | 1 |
| | $= 0.2 \text{ (m/s}^2\text{)}$ | | 1 |
| | 40 – 45 : zero | | 1 |
| (c)(ii) | $\frac{1}{2} \times 20 \times 0.4 = 4 \text{ (m)}$ | | 1 |
| | $5 \times 0.4 = 2 \text{ (m)}$ | | 1 |
| | $4 + 2 = 6 \text{ (m)}$ | | 1 |

(Total 14 marks)

Question 7

(a)(i)	1.5 x 0.5 x 120	90 scores 1 out of 2	1
	x 60 = 5400 (J)		1
(a)(ii)	d.c.		1
(a)(iii)	d.c. current always in same direction / current constant	dependent on (i)	1
	a.c. current would go negative / vary		
(b)	$Q = I \times t$ or $I = \frac{Q}{t}$		1

(Total 5 marks)

Question 8

(a)(i)	sensible use of grid and correct orientation		1
	axes labelled with quantities and units		1
	points plotted correctly to ± 1 mm	-1 for each misplot up to a maximum of 2	2
(a)(ii)	smooth curve		1
(b)	540 m	520 m –560 m	1

(Total 6 marks)

Question 9

- | | | | |
|---------|--|---|---|
| (a) | recall $n = \sin i / \sin r$ | | 1 |
| | $\sin 36^\circ / \sin 23^\circ = 1.50$ | | 1 |
| (b)(i) | more | | 1 |
| (b)(ii) | dop
n greater
therefore r less for same i | slows down more
r less than 23° | 1 |
| (c) | <u>Technicians list</u>
raybox/pins/laser
paper
board
protractor
rule
set square
pencil/pen | ANY FOUR
torch(0) | 4 |

(Total 8 marks)

Question 10

- | | | | |
|----------|--|--|---|
| (a)(i) | I correctly labelled | | 1 |
| (a)(ii) | N on left

S on right | must ecf from (i0) | 1 |
| (a)(iii) | move magnets closer together
more turns on coil
increase current | ANY TWO
stronger magnets

reduce value of variable
resistance | 2 |
| (b)(i) | recall $GPE = m \times g \times h$ | | 1 |
| | $0.080 \times 10 \times 0.70 = \underline{0.56}$ (J) | | 1 |
| (b)(ii) | 0.56 (J) | ecf | 1 |
| (b)(iii) | $= 0.56 / 4 = 0.14$ | ecf from (ii) | 1 |
| | W | J/s | 1 |

(Total 9 marks)

Question 11

- | | | |
|----------|---|---|
| (a)(i) | some (of the remainder) were deviated through large angles | 1 |
| (a)(ii) | concept of a nucleus | 2 |
| | positive charges confined to the nucleus | |
| | negative charges around the outside of the atom/outside nucleus | |
| | ANY TWO | |
| | 2 nd mark scores 2 | |
| (b)(i) | detect (alpha) particles/show flashes of light | 1 |
| (b)(ii) | direct alpha particles at foil/protect operator | 1 |
| (b)(iii) | avoid collisions between alpha particles and air (gas) particles/so they reach gold foil/avoid ionisation | 1 |
| (c) | alpha superscript 4 subscript 2 | 1 |
| | thorium superscript 229 ecf | 1 |
| | thorium subscript 90 ecf | 1 |

(Total 9 marks)

Question 12

(a)	neutron collides with uranium nucleus	ANY THREE	3
	uranium splits (into two fission fragments)		
	plus 2 or 3 neutrons		
	releasing (kinetic) energy	small number – no other specified number heat energy (0)	
(b)	top – control rod	one correct response 1	2
	middle – fuel rod	all correct 2	
	bottom – moderator		
(c)(i)	<i>control rods</i> absorb neutrons		1
	slow down/stop reaction	control rate of reaction	1
(c)(ii)	<i>moderator</i> slow down neutrons		1
	encourage fission		1

(Total 9 marks)

TOTAL FOR PAPER : 90 MARKS

Paper 7

1.

**Food
type**

**Test
solution**

(4)

Total 4 marks

2.

- (i) D;
- (ii) A;
- (iii) B;
- (iv) C;

All 4 or 3 = **(3)**; 2 correct = **(2)**; 1 correct = **(1)**

(3)

Total 3 marks

- 3.** (a) larvae prefer dark conditions / more on dark side;
ACCEPT converse

(1)

- (b) (i)

Experiment

**Num
o'
larv
in li**

1

3

2

2

light and dark columns;
experiment column;
numbers match;
total/average column;

**max
(3)**

- (ii) more larvae found in dark / prefer dark;

(1)

- (c) repeat in dark / light;
equal temperature / humidity / eq;
IGNORE repeat alone / leave for longer

**max
(1)**

Total 6 marks

4. (a) (i) 71; (1)
- (ii) 94.67 / 94.66 / 94.6 / 94.7;;
answer in (i) divided by 75 for one max (2)
- (b) to calculate average / so results are more reliable;
IGNORE accurate / precise / fair test (1)
- (c) fewer seeds germinate; (1)
- (d) light;
keep all seeds in dark / cupboard / same room / eq;
or
temperature; max
keep all seeds in incubator / water bath / near lamp; (2)

Total 7 marks

5. (a) 6.67 plants per m² / accept 6.6 to 6.7;;
20 for one max (2)
- (b) 17;
11; (2)
- (c) size (at least half of each axis);
label (species and A and B);
axis (number of plants and numbers);
plot;; (5)
- (d) more plants in A;
more plantain in trampled area / A;
less groundsel in trampled area / A;
dandelion the same;
daisies the same;
plantain can tolerate trampling;
groundsel cannot tolerate trampling;
dandelion unaffected by trampling;
daisies unaffected by trampling; max
(2)

Total 11 marks

6. (a) increasing temperature increases KE of molecules / more collisions / increases enzyme activity; **(1)**
- (b) 14; **(1)**
- (c) (i) as temperature increases;
the number of bubbles / photosynthesis / rate increases /
30°C is best temperature for photosynthesis; **(2)**
- (ii) yes / no qualified;
only up to 30°C / decrease at highest temperature / at 35°C; **(2)**
- (d) result 1 for 20°C / any result at 35°C; **(1)**
- (e) (i) temperature (constant/controlled);
electronic / thermostatically controlled water bath / digital
thermometer / eq; **max**
- or
bubbles / volume / amount of gas; **(2)**
- (ii) measuring cylinder / syringe / two people counting;
increase above 35°C / decrease below 15°C / smaller
increments;
to see if the rate of photosynthesis alters;
or
use other species;
compare pattern; **(2)**
- (f) (i) carbon dioxide / light; **(1)**
- (ii) add stated volume of sodium hydrogencarbonate to the pond
water / same distance / intensity / wattage;
IGNORE same place/amount **(1)**

Total 13 marks

7. C – two or more stated concentrations of amylase / enzyme;
O – same source of enzyme / human / fungus;
R – repeat tests for each concentration;
M1 – ref to time;
2 - iodine solution / Benedict's;
3 - black to yellow / blue to red / idea of colour change;
S1 – same / stated concentration/volume of starch;
2 - same temperature / water bath; **max**
- 3 - equal volume of amylase / enzyme; **(6)**

Total 6 marks

PAPER TOTAL 50 MARKS

Paper 8

1. (a) A burette (1)
B pipette (1)
C conical flask (1)
D (filter) funnel (1)

- (b) (i) D (1)
(ii) A (1)

Total 6 marks

2. (a) they would dissolve (in the water) (1)
- (b) water rises up paper (1)
colours separate / new colours appear / dyes move up paper (1)
- (c) (i) 3.5 cm (1)
(ii) Q and R (1)
(iii) use another liquid/organic solvent / use longer paper (1)

Total 6 marks

3. (a) amount/mass/volume of organic liquid (1)
OR temp of water (in beaker) (1)
- (b) organic liquids are flammable/would catch fire (1)
- (c) 67 (°C) (1)
52 (s) (1)
- (d) (i) Z (1)
(ii) X (ALLOW Z) (1)
(iii) 50 (s) (1)
(iv) Z (1)
(v) X (1)
- (e) (i) (fractional) distillation (1)
(ii) label line entering lower half of flask being heated (1)
(iii) (water / Liebig) condenser (1)
(iv) boiling point (1)

Total 13 marks

4. (a) air expands on heating / contracts on cooling **(1)**
NOT just 'fair test'
- (b) (i) 60 (cm³) **(1)**
45 (cm³) **(1)**
(ii) 90 of air and 72 of gas **(1)**
18 of oxygen (*ECF from air and gas volumes*) **(1)**
- (c) points plotted correctly: 5 correct = **2**, 4 correct = **1** **(2)**
line of best fit **(1)**
- (d) second point circled **(1)**
- (e) (i) higher **(1)**
(ii) (magnesium) combines with oxygen (in air) **(1)**
(iii) no graduation marks on jar / wider cross-section **(1)**

Total 12 marks

5. (a) number of moles/mass of MnO₂ **(1)**
- (b) **D** **(1)**
- (c) (B) 40 14
(C) 50 25
(D) 50 20
(E) 70 40
Award up to 2 marks for concentrations **(2)**
Award up to 2 marks for rates **(2)**
In each case: all four correct = **2**
three or two correct = **1**
- (d) (i) points plotted correctly: 5 correct = **2**, 4 correct = **1** **(2)**
line of best fit **(1)**
(ii) rate is (directly) proportional to concentration **(1)**
- (e) repeat experiment(s) using:
same concentration/volume of H₂O₂ solution
same temperature
same amount of solids
same surface area of solids
measure time to collect fixed volume of O₂ gas } *any three* **(3)**

Total 13 marks

TOTAL FOR PAPER 50 MARKS

Paper 9

Question 1

Part	Answer(s)	Extra Information	Mark(s)
(a)	34 (cm ³)		1
(b) (i)	appropriate headings (1)	example	3
	all in order (1)	number of marbles	
	no 'unit' given for marbles and cm ³ or ml for volume (1)	1 39 2 50 3 61 4 72 5 91 6 94	
		allow consequential credit thereafter if, for example, one or more pairs are not listed	
(ii)	both axes labelled with quantity and unit (1)	allow error carried forward	3
	all points correctly plotted to within 1 mm in any direction (2)	deduct (1) for up to each of two points which is incorrect or a blob	
(iii)	5, 91	or otherwise correctly identified	1
(iv)	straight line of best fit	a ruler has been used and the anomalous result has been disregarded	1
(v)	28 (cm ³ /ml)	or correct from candidate's line	1
(vi)	105 (cm ³)		1

- (c) use scales/(top pan) balance
(1)
to find the mass of the marbles
(1)

do not credit 'weight ...'

do not credit if this is done at
the end when the marbles are
wet

put water in the measuring cylinder
and note its volume

(1)

use enough water so that (you judge)
it will cover the marbles (when they
are added)

(1)

but not too much so that it will/is
likely to overflow

(1)

add marbles, note volume then
difference in volume = volume of
marbles

(1)

do not credit if it is stated or
implied that only one marble
is used

(Total 17 marks)

Question 2

Part	Answer(s)	Extra Information	Mark(s)
(a) (i)	newtonmeter	or newton balance or spring balance	1
(ii)	17	do not credit '23'	1
(iii)	(clamp/retort) stand	do not credit 'holder'	1
(b) (i)	ruler	allow 'metre rule' allow 'tape measure'	1
(ii)	22 (mm)	allow any value between 21- 22 mm inclusive	1
(c)	130 (mm)		1
(d) (i)	75 (mm)		1
(ii)	all four points 'correct' (2) just three points 'correct' (1)	correct means not 'blobs' and centre correct to 1 mm any direction	2
(iii)	straight line of best fit through the origin	a ruler has been used	1
(iv)	either extension is (directly) proportional to (the) load (2) or spring obeys Hooke's Law (2)	allow converse (2) or just 'as load gets bigger so does the extension' (1)	2
(v)	valid suggestion (1) appropriate explanation (1)	examples more readings/ results/ measurements to improve reliability measure extension as unloaded to check that (elastic) limit has not been exceeded repeat readings to check (accuracy)	2

(Total 14 marks)

Question 3

Part	Answer(s)	Extra Information	Mark(s)
(a)	88 (°C)		1
(b)	measure the diameter of the beakers (1) calculate half the difference (1)	accept 'measure across the beakers' or d = half the difference or d = the difference in radii (of the beakers) for both marks	2
(c) (i)	starts at the same point (1) steeper gradient (1) levels out at the same (room) temperature (1)	not just stops at the dashed line	3
(ii)	so that the results can be compared	or so that any difference is due only to the thickness (of the insulation) or so it's a fair test do not credit 'it's a control (experiment)'	1
(d)	suggested improvement (1) appropriate explanation (1)	examples stir the water before taking the temperature (1) to get a better (average) result (1) have an insulated/ better fitting/ non-metal lid (1) to reduce heat loss (through the lid) (1)	2
(e)	cools more quickly (1) either damp sawdust is not such a good insulator (1) (because) (trapped) water is not such a good insulator as (trapped) air (1) or (some of the) water (in the damp sawdust) will evaporate (1) this will cause/increase heat loss (1)	or 'graph line is steeper' for either mark, credit words to that effect in terms of conduction	3

(Total 12 marks)

Question 4

Part	Answer(s)	Extra Information	Mark(s)
(a)	heatproof mat used to protect the bench (1) water in beaker, supported by tripod and gauze, heated by spirit burner (1) thermistor and thermometer in water (1) move/adjust spirit burner to (try to) keep temperature constant/at 60 °C (1)	this and other marks may either be from written response or from candidate's diagram but do not credit if these contradict	4
(b) (i)	0.66 (A)		1
(ii)	4.2(0) (V)		1
(c)	it/resistance will increase because resistance decreases as it gets hotter/ temperature rises	allow '...because resistance (of a thermistor) increases as it gets cooler/ temperature falls' credit '...because less free /available electrons' do not credit '...because resistance is inversely proportional to temperature'	1

(Total 7 marks)

Total for Paper 3 = 50 marks

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