CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0654 CO-ORDINATED SCIENCES

0654/32 Paper 3 (Extended Theory), maximum raw mark 120

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2014 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

1 **(a)** helium
zinc
aluminium
chlorine ;; (4 correct = 2 marks, 3 or 2 correct = 1 mark) [2]

(b) (**D**)
reference to high conductivity ;
quick reaction in water ;
moderate melting point / owtte ; [max 2]

(c) **(i)** zinc + copper sulfate → zinc sulfate + copper ; [1]

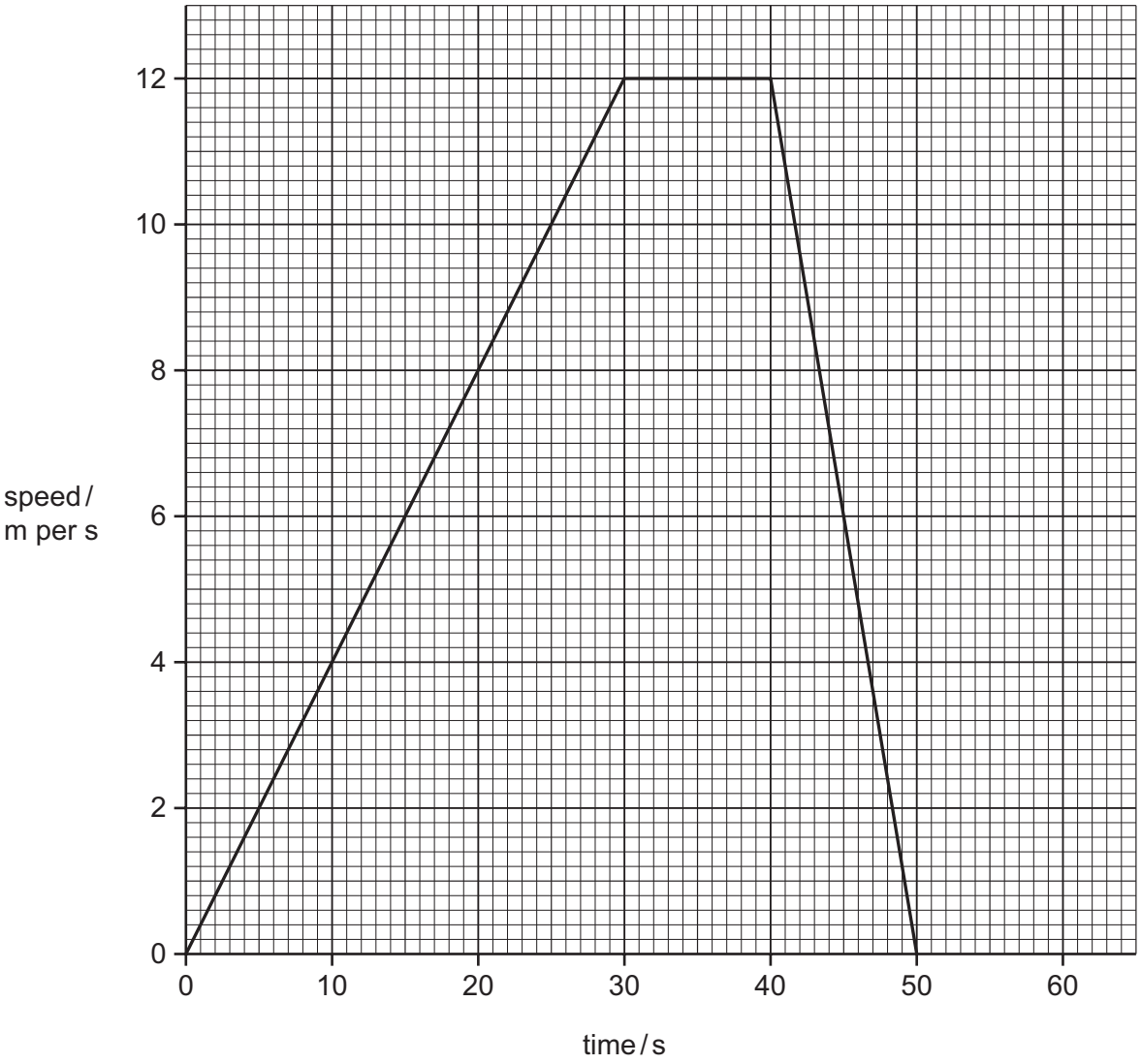
(ii) zinc has displaced copper / copper formed / deposited (on nail) ;
zinc is more reactive than copper ; [2]

(d) **(i)** oxygen ; [1]

(ii) (positive) copper ions move towards / are attracted to the negative cathode ;
copper ions gain electrons ;
allow copper ions, each gain two electrons / are discharged / are converted to atoms ; [3]
(allow electrode equation $Cu^{2+} + 2\ e^- \rightarrow Cu$ for max 2 marks)

[Total: 11]

2 **(a)** all four key points identified ;
only positive gradient for acceleration, only negative gradient for deceleration, straight line for constant speed ; [2]



(b) **(i)** area under graph ; [1]

(ii) $\frac{1}{2} \times 25 \times 10 + 20 \times 10 + \frac{1}{2} \times 15 \times 10$;
= 400 (m) ; [2]

(c) (work) = force × distance (**OR** (work) = (change in GPE) = mgh) ;
= 80 × 60 × 10 = 48 000 ;
J ; [3]

[Total: 8]

3 **(a)** action by body to maintain ;
constant internal environment / owtte ; [2]

(b) **(i)** insulin ; [1]

(ii) pancreas ; [1]

(c) vasodilation ;
muscle relaxation at **X** / arteriole ;
so more blood flows through **Y** / capillary / towards skin ;
so heat lost from blood at skin surface ; [max 3]

(d) **(i)** vasoconstriction / contraction of arterioles ; [1]

(ii) cold will stimulate the vasoconstriction response, (ORA) / to prevent frostbite / prevent numbness / AW ; [1]

(iii) death of tissue ;
due to lack of respiration ;
due to lack of oxygen / glucose ;
AVP, e.g. muscle / skin / tissue atrophy / ulceration ; [max 2]

[Total: 11]

4 **(a)** **(i)** *hydrogen and carbon*
(each) contains one type of atom / is found in the Periodic Table / cannot be broken down into simpler substances ;
propane
contains different atoms (allow elements) bonded together / can be broken down into simpler substances / into elements ; [2]

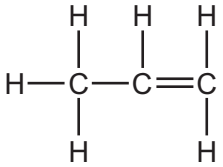
(ii) petroleum / natural gas / crude oil ; [1]

(iii) fractional distillation ; [1]

(iv) heating / lighting / burners / cooking / vehicle fuel / refrigerant / feedstock / propellant (for aerosol cans) ; [1]

(b) **(i)** only single bonds / no double bonds (in a molecule) / contains maximum possible hydrogen atoms ; [1]

(ii)



3 × C and 6 × H OR 3C with one double bond ;
all else correct ; [2]

(iii) propane molecules contain three carbon atoms ;
methane / ethene contain fewer than three carbon atoms ; [max 2]
propane is changed to methane and / or ethane but not propene ;

[Total: 10]

5 **(a)** reference to induced magnetism / iron can be magnetised ;
north pole of bar magnet attracts induced south pole of iron piece ; [2]

(b) **(i)** relay uses a low current to switch on a high current ;
safety qualified by context ; [2]

(ii) magnetised coil ;
attracts armature ;
(armature) closes main circuit ; [2]

(c) **(i)** 0.45 (A) ; [1]

(ii) 3.0 (V) ; [1]

(iii) V = IR ;
$= \frac{3}{0.3} = 10\ (\Omega)$; [2]

(iv) combined resistance of L_1 and L_2 is 20 (Ω) ; [1]

(v) $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$;
$= \frac{1}{10} + \frac{1}{20}$;
R = 6.7(Ω) ;
(*R = V / I using total current of 0.45 A and voltage = 3 V*) [3]

[Total: 14]

6 **(a)** **(i)** 80 ; [1]

(ii) $\frac{24}{80} \times 100$;
= 30 (%) ; [2]

(b) heat / thermal (energy) ; [1]

(c) for muscle contraction / protein synthesis / cell division / growth / passage of nerve impulses / maintenance of body temperature ; [1]

(d) (i) more used in respiration / less used for new tissue ;
respiration produces heat to keep warm ; [2]

(ii) more lost in faeces / less absorbed ;
because more fibre ; [2]

[Total: 9]

7 (a) (i) curve above original at all times ;
approx. 50 cps (one square) above ; [2]

(ii) working shown on graph or elsewhere ;
6 (hours) ; [2]

(iii) lasts long enough to travel to target organ ;
will only irradiate body for a short period / does not linger in the environment for too long ; [2]

(b) more penetrating – easier to monitor / not stopped by skin ;
less ionising – causes less damage to body cells ;
gamma ray energy / wavelength easy to detect using X-ray detectors ;
gamma can leave body easily / AW ; [max 2]

(c) (i) ultra violet and then radiowaves ; [1]

(ii) gamma (end) / left hand side ; [1]

(iii) distance between identical points (on two waves) ; [1]

(d) electrons are transferred ;
loss of electrons (on cloth or balloon) means positive charge (or vv) ; [2]

[Total: 13]

8 (a) a thread of DNA ;
made up of / carrying (a string of) genes ; [2]

(b) (i) diploid ;
because chromosomes are in pairs / two sets of chromosomes ; [2]

(ii) haploid / not paired / half as many / AW ;
no Y chromosome / only X chromosome ; [2]

(c) (i) **M** on the arrow(s) from wingless stages to egg / sperm ; [1]

(ii) egg and sperm = 6 ;
all others = 12 ; [2]

(d) (i) creates genetic variety / produces eggs to survive winter ; [1]

(ii) rapid increase in numbers / no partner needed; [1]

[Total: 11]

9 (a) 16 electrons ;
electron configuration of 2,8,6 ; [2]

(b) (i) 4 ; [1]

(ii) dissolves / mixes / reacts with rain water / water in the air ;
rain water becomes acidic / now contains (dilute) sulfuric acid ;
acid rain falls into lake ;
water evaporates but sulfuric acid does not ; [max 2]

(c) (i) increasing the temperature decreases the time to fill the cylinder ; [1]

(ii) increasing temperature increases rate of reaction ;
increasing temperature increases speed / kinetic energy of particles ;
which increases the collision frequency between acid particles and magnesium ;
which increases chance of reaction resulting from collision / more effective or successful collisions ; [max 2]

(d) (i) look for $120 \div 24000 = 0.005$ or 5×10^{-3} ; [1]

(ii) statement that reacting moles Mg : H_2SO_4 = 1:1 or 0.005 moles of magnesium
required ;
look for $0.005 \times 24 = 0.12$ (g) of magnesium required ; [2]
(allow ecf from **(i)**)

[Total: 11]

10 (a) taking in nutrients / organic substances (and mineral ions) / raw materials ;
absorbing them and assimilating them ;
using them for growth / tissue repair ; [max 2]

(b) (i) bacteria / *Lactobacillus* ; [1]

(ii) so respiration is <u>anaerobic</u> / prevents <u>aerobic</u> respiration ; [1]

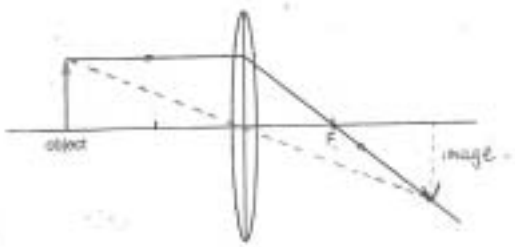
(iii) remove other micro-organisms ;
other micro-organisms might produce toxins / be harmful ;
would compete with the yoghurt bacteria ; [max 2]

(iv) (too much fat) linked to heart disease ;
reference to obesity / cholesterol ; [2]

(v) production of lactic acid ; [1]

[Total: 9]

11 (a)



(i) as shown on diagram ; [1]

(ii) as shown on diagram ; [1]

(iii) principal focus ; [1]

(b) (i) same size and inverted (both required – either order) ; [1]

(ii) a real image can be projected onto a screen / a virtual image cannot be projected on a screen ; [1]

[Total:5]

12 (a) (i) nitric (acid) ; [1]

(ii) NH_4^+ ;
evidence of idea that charges must balance ; [2]

(b) (i) $CH_4 + H_2O \rightarrow CO + 3H_2$;;; [3]
(LHS formulae ; RHS formulae ; then balance ;)
(*allow max 2 if only error is 6H*)

(ii) high pressure / 80 to 200 atm
temperature 400 – 500 °C
(iron) catalyst ;; [2]
(*all three for 2 marks and any two for 1 mark*)

[Total: 8]