Y12 Transition Work: Exam Practice Booklet

MARK SCHEME

Mark schemes

**Q1.**

(a)  transfer of electrons

*mention of positive charge moving negates both marks*

**1**

from the carpet to the student

**1**

(b)  three arrows perpendicular to sphere’s surface with all arrows directed inwards and distributed evenly around sphere

**1**

(c)  there is a potential difference between the student and the tap

*do* ***not*** *accept the tap / sink is charged*

**1**

which causes electrons / charges to transfer from the student

**or**

which causes electrons / charges to transfer to the tap

**1**

which earths the charge

*allow the tap is earthed*

**1**

(d)  carpet / copper has a low resistance

*allow carpet is a conductor*

***or***

*copper is a conductor*

**1**

lower / no build-up of charge (on the student)

**or**

(so there is a) smaller / no potential difference between student and tap / earth

**1**

**[8]**

**Q2.**

(a)  The particles move in random directions.

**1**

The particles move with a range of speeds.

**1**

(b)  100 000 × 0.030 = 3000

**1**

p × 0.025 = 3000

*allow a correct substitution using an incorrectly calculated value using pV = constant*

**1**

p = 

*allow a correct rearrangement using an incorrect value of the constant*

**1**

p = 120 000 (Pa)

*allow a correct calculation using an incorrect value of the constant*

*allow correct substitution into p1V1 = p2V2 for first 2 marking points*

**1**

(c)  particles would have a higher (mean) kinetic energy

*allow particles would have a higher (mean) speed*

*do not accept particles vibrate more*

**1**

(so) increased number of collisions with the walls of the balloon per second

*allow greater frequency of collisions with the walls of the balloon*

**1**

greater forces exerted in collisions (between particles and balloon walls)

*allow greater rate of change of momentum (of particles)*

**1**

greater force exerted on same area

*allow description using p=F/A*

**1**

**[10]**

**Q3.**

(a)  smoke absorbs / stops alpha radiation

*allow alpha particles for alpha radiation*

*alpha radiation does not reach the detector is insufficient*

**1**

(b)  alpha radiation is not very penetrating

*allow alpha particles for alpha radiation*

**or**

alpha radiation does not penetrate skin

*allow alpha radiation does not travel very far (in air)*

**1**

(c)  beta and gamma radiation will penetrate smoke

*allow beta and gamma radiation will not be stopped by smoke*

**1**

no change (in the count rate) would be detected

*allow the change detected (in the count rate) would be too small*

**1**

(d)  (a long half-life means) the count rate is (approximately) constant

*allow activity of source is (approximately) constant*

**or**

a short half-life means the count rate decreases quickly

**1**

until 1.3 half-lives the count rate is above 80 per second

*allow after 1.3 half-lives the count rate is below 80 per second*

**or**

until 1.3 half-lives the count rate is above the threshold for the smoke alarm to be activated

**or**

after 1.3 half-lives the smoke alarm will be activated all the time

*so don’t have to replace source or smoke detector is insufficient*

**1**

(e)  **Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

**3−4**

**Level 1:** Relevant points (reasons / causes) are identified, and there are attempts at logically linking. The resulting account is not fully clear.

**1−2**

**No relevant content**

**0**

**Indicative content**

•   short half-life or half-life of a few hours

•   (short half-life means) less damage to cells / tissues / organs / body

•   low ionising power

•   (low ionising power means) less damage to cells / tissues / organs / body

•   highly penetrating

•   (highly penetrating means) it can be detected outside the body

•   emits gamma radiation

**[10]**

**Q4.**

(a)  Any **one** from:

•   (medical) x-rays

*allow CT scans*

•   radiotherapy

•   nuclear weapons (testing)

*allow nuclear fallout*

•   named nuclear disaster e.g. Chernobyl / Fukushima / Three Mile Island.

*ignore radioactive / nuclear waste*

**1**

(b)  uranium / plutonium

*ignore any number given*

*allow thorium*

**1**

(c)  neutron absorbed by a uranium nucleus

**1**

nucleus splits into two parts

*allow an atom splits into two parts if 1st marking point doesn’t score*

**1**

and (2/3) neutrons (are released)

**1**

and gamma rays (are emitted)

**1**

(d)  lighter nuclei join to form heavier nuclei

*allow specific examples*

**1**

some of the mass (of the nuclei) is converted to energy (of radiation)

**1**

(e)  activity decreases quickly

*allow nuclei / waste will decay at a greater rate*

*ignore waste is radioactive for less time*

**1**

risk of harm decreases quickly

*allow burial site doesn’t need to be monitored for as long*

***or***

*doesn’t need to be buried underground for as long*

***or***

*may not need to be buried underground*

**1**

**[10]**

**Q5.**

(a)     60

*allow* ***1*** *mark for correct substitution (with d in metres),
ie 36 = F × 0.6*

*an answer of 0.6* ***or*** *6 gains* ***1*** *mark*

**2**

(b)      the line of action of the weight lies outside the base / bottom (of the bag)

*accept line of action of the weight acts through the side*

*accept the weight (of the bag) acts outside the base / bottom
(of the bag)*

**1**

a resultant / overall / unbalanced moment acts (on the bag)

*accept the bag is not in equilibrium*

*do* ***not*** *accept the bag is unbalanced*

**1**

**[4]**

**Q6.**

(a)  upthrust acts upwards

**1**

normal contact force acts upwards

**1**

weight – (upthrust + normal contact force) = 0

*allow resultant force equal to zero only if all three forces and correct direction are given*

**1**

(b)  A = 0.25 × 0.10 = 0.025 m2

**1**

****

*allow correct substitution of incorrectly calculated value of A*

**1**

P = 25 480 Pa

*allow correct calculation using and incorrectly calculated value of A*

*to gain further marks, P = F/A must have been used*

**1**

25 480 = 2.5 × ρ × 9.8

*allow correct substitution of incorrectly calculated value of P*

**1**

****

*allow correct rearrangement using an incorrectly calculated value of P*

**1**

ρ = 1040 kg/m3

*allow correct calculation using an incorrectly calculated value of P*

**1**

(c)  force = 618 × 

**1**

force = 12 3335.28

*this answer can score the first* ***2*** *marks*

**1**

force = 12 300 (N)

*allow max of* ***2*** *marks if 50 m is used*

*full credit can be given if ρ is calculated: ρ = 1009 kg/m3*

**1**

**[12]**

**Q7.**

(a)  (total) momentum before = (total) momentum after

*allow (total) momentum stays the same*

**1**

(b)  momentum of player A = 585 (kg m/s)

**1**

momentum of player B = –500.5 (kg m/s)

**1**

****

OR



*allow *

**1**

= 0.5 (m/s)

*this answer only*

**1**

(c)  (protective pads) increase the time taken to stop (during the collision)

*allow increases impact / contact / collision time*

*do* ***not*** *allow slows down time*

**1**

so the rate of change of momentum decreases

*allow reduces acceleration/deceleration*

*allow increases the time to reduce the momentum to zero for* ***2*** *marks*

**1**

reducing the force (on the ice hockey player)

*allow impact for force*

*do* ***not*** *allow if linked to an incorrect explanation*

**1**

**[8]**

**Q8.**

(i)      (partly) reflected when they hit a (boundary between two) different media
or substance or tissue

*accept named substances*

*do* ***not*** *accept bounce back*

**1**

time taken for reflected wave (to return) is used to produce the image

**1**

(ii)      any **one** from:

          cleaning a delicate mechanism / jewellery

*do* ***not*** *accept cleaning*

          welding plastics

          cutting textiles

          mixing emulsion paints

          sonar

          motion sensors (in burglar alarms)

*do* ***not*** *accept burglar alarms*

          removing dental plaque

          industrial quality control

          breaking up kidney stones

          treating injuries

**1**

**[3]**

**Q9.**

(a)  focal length

*this answer only*

**1**

(b)  one correct line drawn from the top of the object, passing through the lens and crossing or meeting given line

*ignore any arrow drawn on the line*

*if two lines are drawn, both must be correct*

**1**

inverted image drawn at the correct position and length

*arrowhead required*

**1**

(c)  similarity

(both are) diminished

**1**

difference

concave is virtual and convex is real

**or**

concave is upright and convex is inverted

*allow smaller for diminished*

*a comparison must be made*

*ignore reference to positions of images*

**1**

(d)

*an answer of 1.5 (mm) scores* ***3*** *marks*

**

**1**

****

**1**

object height = 1.5 (mm)

*provided working can be seen, an attempt to convert 9.0 mm to cm or m with all other steps correct scores* ***2*** *marks*

**1**

**[8]**

**Q10.**

(a)     light (inside the tin can) is reflected many times before incident on the hole

**1**

at each reflection energy / light is absorbed so (very) little light / energy leaves the hole

**1**

(b)     the object absorbs all of the radiation incident on it

**or**

the object does not reflect or transmit any radiation

**or**

the object is the best possible emitter of radiation

**1**

(c)     the intensity of every wavelength increases

**1**

the shorter the wavelength the more rapid the increase in intensity

**1**

the peak intensity occurs at shorter wavelength

**1**

(d)     accept any value between 1600 (°C) and 10 000 (°C)

**1**

(e)     the temperature has increased

**1**

as 200 years ago the energy / radiation from space = energy / radiation emitted (and reflected) into space

**1**

but now less radiation is emitted so there is a net absorption

*allow energy for radiation*

**1**

**[10]**

**Q11.**

(a)     (i)      generator

**1**

(ii)     alternating current

**1**

(iii)    voltmeter / CRO / oscilloscope / cathode ray oscilloscope

**1**

(b)     (i)      time

**1**

(ii)     peaks and troughs in opposite directions

**1**

amplitude remains constant

*dependent on first marking point*

**1**

(c)     any **two** from:

•        increase speed of coil

•        strengthen magnetic field

•        increase area of coil

*do* ***not*** *accept larger*

**2**

**[8]**

**Q12.**

(a)  motor (effect)

**1**

(b)  current creates a magnetic field (around the coil)

**1**

(which) interacts with the permanent magnet field

**1**

producing a (resultant) force causing the coil/cone to move

**1**

(when the) direction of the current reverses, the direction of the (resultant) force reverses (producing a sound wave)

*allow coil/cone for force allow backwards for reverses*

**1**

(c)  the student changed two variables at the same time

*allow only one variable should be changed at a time*

**1**

(so) it is not possible to know the effect of each variable

**1**

**[7]**

**Q13.**

(a)     It is easily magnetised.

**1**

(b)     p.d. across the secondary coil is smaller (than p.d. across the primary coil)

**1**

(c)     ratio Vp   =  6

Vs     12

*accept any other correct ratio taken from the graph*

**1**

6 = 50

12   Np

*use of the correct turns ratio and substitution or correct transformation and substitution*

**1**

Np = 100

*allow 100 with no working shown for* ***3*** *marks*

**1**

**[5]**

**Q14.**

(a)  (force of) gravity

*do* ***not*** *allow weight*

**1**

fusion

**1**

(b)  distance = speed × time

*allow a correct re-arrangement*

**or**

s = vt

*do* ***not*** *allow d = st*

**1**

(c)  1.5 × 1011 = 3.0 × 108 × t

**1**

t = 

**1**

t = 500 (s)

**1**

(d)  **Level 3**: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

**5−6**

**Level 2:** Scientifically relevant facts, events or processes are identified and their relevance is clear. The account is not fully accurate.

**3−4**

**Level 1**: Facts, events or processes are identified and simply stated but their relevance is not clear.

**1−2**

**No relevant content**

**0**

**Indicative content:**

•   fusion (processes in stars) produce new elements

•   cloud of gas / hydrogen **and** dust **OR** nebula

•   pulled together by gravity

•   causing increasing temperature (to start the fusion process)

•   (to become a) protostar

•   hydrogen nuclei fuse to form helium nuclei

•   and the star becomes main sequence

•   hydrogen begins to run out

•   helium nuclei fuse to make heavier elements

•   up to iron

•   the star expands (to become a)

•   red super giant

•   (the star collapses rapidly) and explodes

•   called a supernova

•   creating elements heavier than iron

•   and distributing them throughout the universe

•   leaving behind a neutron star

•   or a black hole.

(e)  Temperature

**1**

**[13]**

**Q15.**

(a)  wavelength

*allow a correct answer indicated in the box provided the answer space is blank*

**1**

(b)  C

**1**

(c)  C

**1**

(d)  Very dense and extremely hot

**1**

(e)  Scientific evidence supports the theory

**1**

(f)  Z

**1**

any **one** from

•   (only one) shows the universe is expanding

•   (only one) shows the universe began (very) small

*only scores if Z is chosen*

**1**

**[7]**