Year 11 Physics Exam
Sept. 2005 – Answers

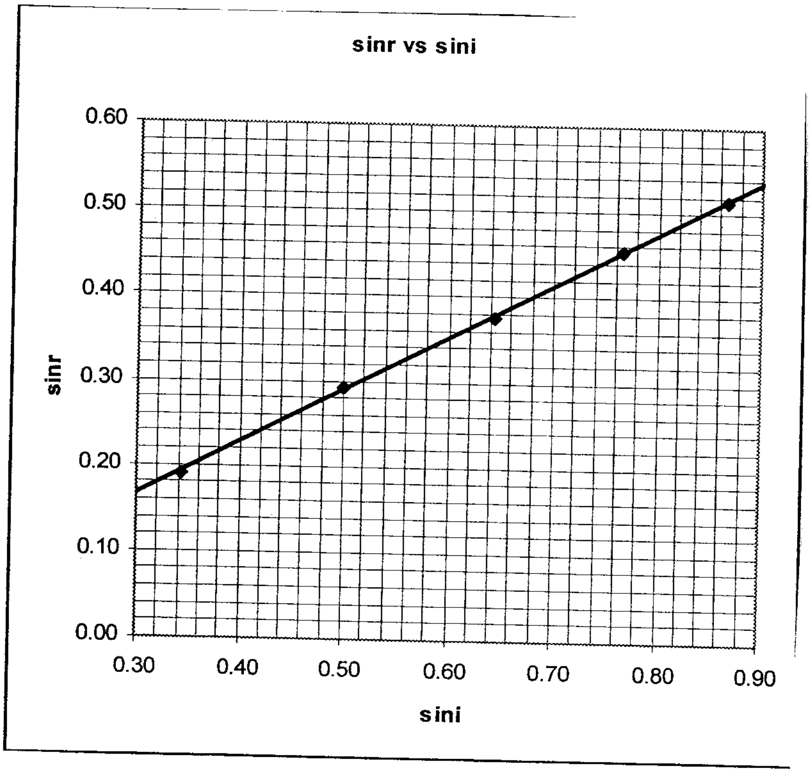
1. C 2. C 3. C 4. B 5. D 6. B 7. B 8. C 9. D

10. A 11. B 12. D 13. A 14. D 15. B

16(a) The candle was placed in the darkroom and lit. The probe for the light meter was placed 10 cm away from the candle. The lights were turned out and the meter results read and recorded. The probe was then placed a further 10 cm away from the candle and the meter results read and recorded. This was repeated until the probe was a total distance of 1 m away from the candle. The results were plotted as intensity vs. inverse square of the distance and the gradient determined.

16(b)
$I_1 d_1^2 = I_2 d_2^2$
$I_2 = 12 \times 40^2 \div 100^2$
$I_2 = 1.9\ Wm^{-2}$

17.(a)

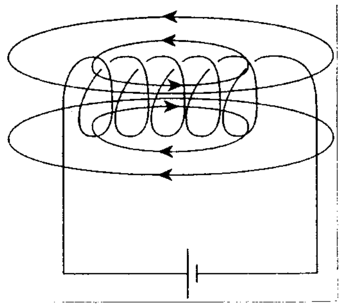


17(b) gradient = 0.62 ✓
~~sinr = 0.62 sini~~
~~sini/sinr = 0.62~~
~~v_1/v_2 = sini/sinr~~
$v_2 = 3 \times 10^8 \times 0.62$
$v_2 = 1.9 \times 10^8\ ms^{-1}$

$\therefore \frac{\sin r}{\sin i} = 0.62 = \frac{V_2}{V_1}$

$\therefore V_2 = V_1 \times 0.62 = 3 \times 10^8 \times 0.62 = 1.9 \times 10^8\ ms^{-1}$

18.



19. This is an extremely undesirable practice as whilst the circuit will not blow a fuse it will allow dangerously high levels of current to flow which could either start a fire or electrocute somebody.

20(a) The current is constant the entire way around the circuit. Therefore, to measure it the ammeter must be placed in series. Since it does not have a high resistance, there will be negligible potential difference across it.

20(b) Before switch is closed:
$P_B = P_A = V^2/R = 9/2 = 4.5$ W

After switch is closed:
$1/R_{BC} = 1/R_B + 1/R_A$
$R_{BC} = 1\ \Omega$
$R_{Total} = 1 + 2 = 3\ \Omega$
$I = V/R = 6/3 = 2$ A
$P_A = I^2R = 2^2 \times 2$
$P_A = 8$ W
$P_B = P_C = I^2R = 1^2 \times 2 = 2$ W
Light bulbs A and B will have equal brightness initially but light bulb A will be the brightest after the switch is closed.

21(a) $p_i = 7.2 \times 80 - 3.2 \times 54$
$p_i = p_f = 403.2$ $kgms^{-1}$
$v = 403.2/134 = 3.01$ ms^{-1} south

21(b) $KE_i = 0.5 \times 80 \times 7.2^2 + 0.5 \times 54 \times 3.2^2 = 2350$ J

21 (c) Energy has been transformed from kinetic energy to sound energy (observers hear the collision) and heat energy (as the 2 bodies push against each other and as the friction of the skates against the ice increases).

22. a

Marking Criteria	Marks
Axes labelled and marked correctly, points plotted and joined by line of best fit correctly	3
Axes labelled, points plotted	2
Some attempt to plot points made	1

22.(b)

From graph:

gradient = 2

∴ F = ma and

for an F v's a graph,

m = slope

∴ m = 2

∴ Mass = 2 kg

Question 23 (6 marks)

Throughout history there have been many different models developed in an attempt to explain the nature of the universe.

(a) Assess ONE of the models of the universe from the time of Aristotle to the time of Newton, clearly identifying any limitations placed on the development of the model by the technology available at the time. 3

Assessment must be done (is the model good, useful etc.?).
Basic details of model must be given.
A "limitation" must be given.

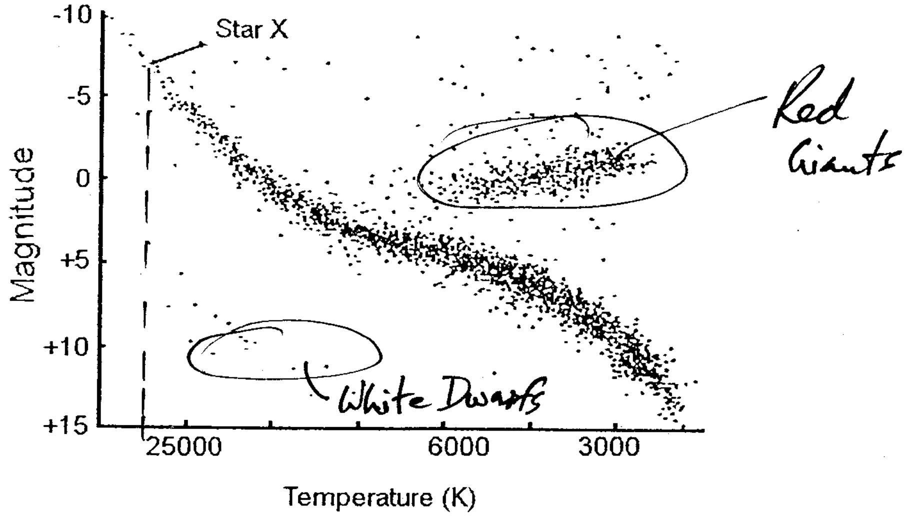
(b) Outline the discovery of the expansion of the universe by Edwin Hubble and identify the Russian Physicist who predicted this expansion. 3

Hubble discovered that the spectra of many galaxies were red-shifted compared to reference spectra in labs on earth. This suggested that these galaxies were moving away from us. That is, the Universe is expanding. Russian Physicist = Alexander Friedmann

4

Question 24 (7 marks) **Marks**

The following diagram shows a star (Star X) on the Hertzsprung-Russell diagram.



(a) Using the diagram, identify the stellar group Star X is in. **1**

Main Sequence

(b) On the HR Diagram above clearly indicate the positions of Red Giant and White Dwarf Stars. **2**

(c) Use the information below to identify the Spectral Class and colour of Star X.

Spectral Class	Colour	Temperature
O	Blue-violet	25000-50000
B	Blue-white	10000-25000
A	White	7500-10000
F	Yellow-white	6000-7500
G	Yellow	5000-6000
K	Orange	3500-5000
M	Red-orange	2500-3500

Spectral Class: O **1**

Colour: Blue-violet **1**

(d) Identify the type of nuclear reaction occurring in the core of Star X and the fuel being used for this reaction.

Type of reaction: (Hydrogen) Fusion **1**

Fuel for reaction: Hydrogen **1**

25 (a) After intense sunspot activity, one can expect the ability to communicate via shortwave radio to be disrupted. UHF and VHF satellite communications will also be disrupted. Electrical power supply can be disrupted as transformers are destroyed. The drag on low Earth satellites can increase, even causing them to crash to Earth. High-orbit satellites can be destroyed due to a malfunction of the electronic components.

25(b) Sunspots are relatively cool regions on the Sun but they have a high magnetic field. They will emit plasma in huge quantities into space. This ejection increases the radiation escaping the Sun's atmosphere (the solar wind). The solar wind contains, among other things, UV rays and X-rays, electrons and protons. The UV rays and X-rays ionise the particles in the Earth's atmosphere, making them able to absorb radio transmissions. They also create irregularities in the Earth's ionosphere hindering the UHF and VHF transmissions. The van Allen belts will become overloaded with charged particles, which will spiral down towards the Earth (near the poles). This flow of charge creates a varied magnetic field which in turn creates a charge that flows through the Earth, causing damage to transformers. Drag on the low Earth satellites is caused by the expansion of the Earth's atmosphere due to its heating by UV and X-ray emissions. The bombardment of high-orbit satellites with electrons will create damage to the electronic circuits as they are shorted.

26. a. Calculate the acceleration of the car. 2

$F = ma$ and Net force on car = 150 N

$\therefore a = F/m = 150/750$

$= 0.2\ ms^{-2}$ to the left.

26. b. How fast will the car be moving after 8.0s? Assume all the forces on the car remain constant. 2

Either: $I = \Delta p = F.t$

$m.\Delta V = F.t$

$750\,\Delta V = 150 \times 8$

$\therefore \Delta V = 1.6\ ms^{-1}$

$\therefore$ After 8s, car has speed of $11.6\ ms^{-1}$.

Or: $V = u + at$

$V = 10 + 0.2 \times 8$

$= 11.6\ ms^{-1}$